WELD Experiences

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Landsat Analysis Ready Data Session
Winter Landsat Science Team Meeting,
Newman Library Multipurpose Room,
Virginia Tech, Blacksburg, VA
January 12-14 2016

USGS science for a changing world

NASA

SDSU

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Remote Sensing of Environment

journal homepage: www.elsevier.com/locate/rse

Landsat-8: Science and product vision for terrestrial global change research

- The provision of 'higher-level' Landsat products, i.e., geographically seamless, gridded products that have been subject to geophysical transformations and processed to derive environmental variables over different time periods (monthly, seasonal, annual), have been advocated by the LST and by the user community.

- Higher-level products are needed to meet demands for consistently processed, moderate spatial resolution, large area, long-term terrestrial data records for climate and global change studies, to help national and international reporting linked to multilateral environmental agreements, and for regional and national resource management applications.

What the Landsat user community wants …

Summary Slide from a David Roy presentation at the
Landsat Science Team Meeting, January 19-21, 2010
Computer History Museum, 1401 N Shoreline Boulevard, Mountain View, CA 94043

- Derived Landsat data products for free

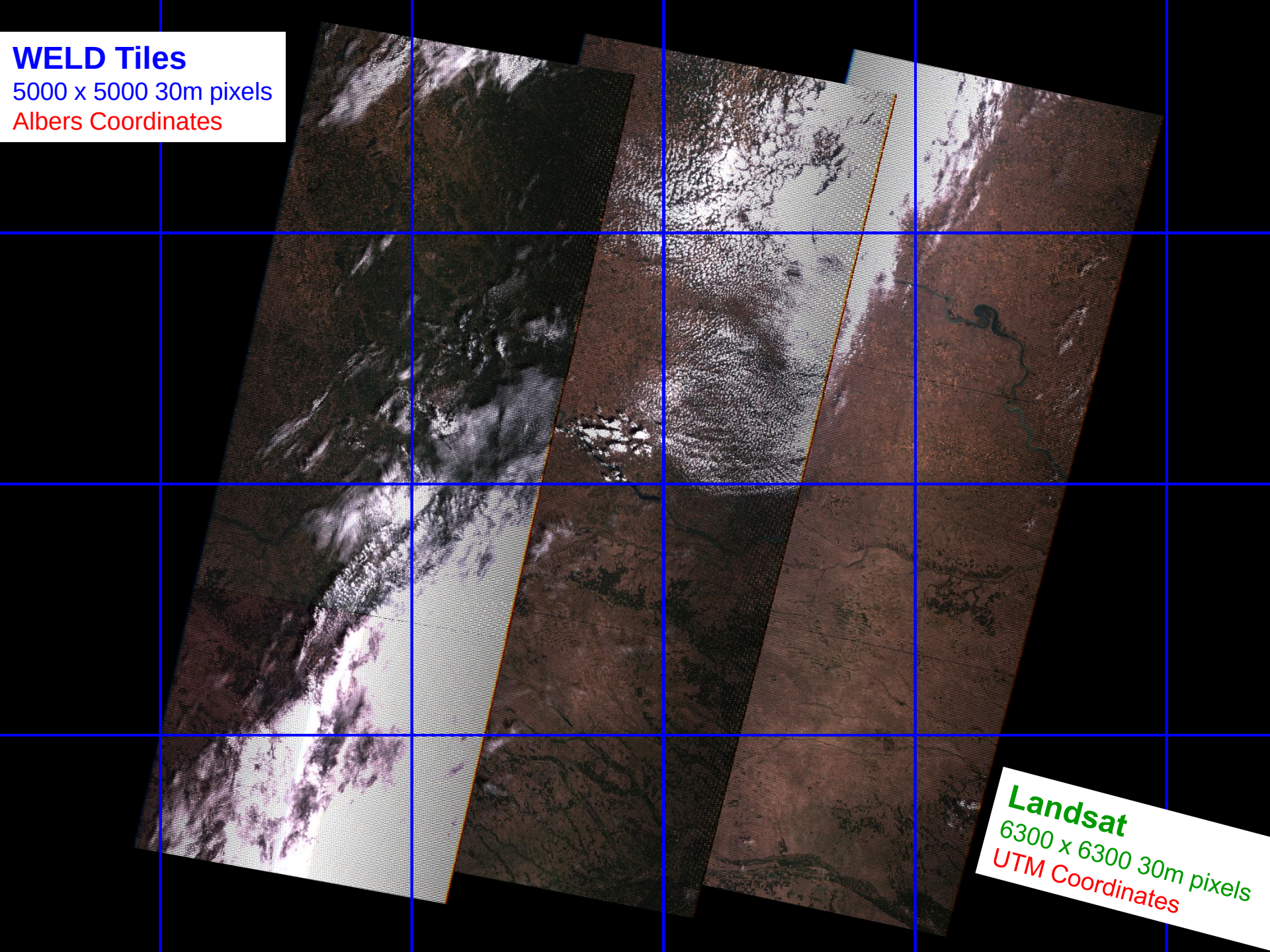
- Systematic, consistent, community endorsed data processing
  - calibration, geolocation
  - radiometric normalization / BRDF correction, atmospheric correction
  - cloud-screened, snow-screened, SLC-off gap filling
  - needed in order to derive higher level bio/geophysical products

- Composited large-area data product mosaics
  - updated at the pixel level
  - using all the Landsat data, not just select acquisitions
  - processed shortly after acquisition i.e. “near real time”

- A long term Landsat data product record

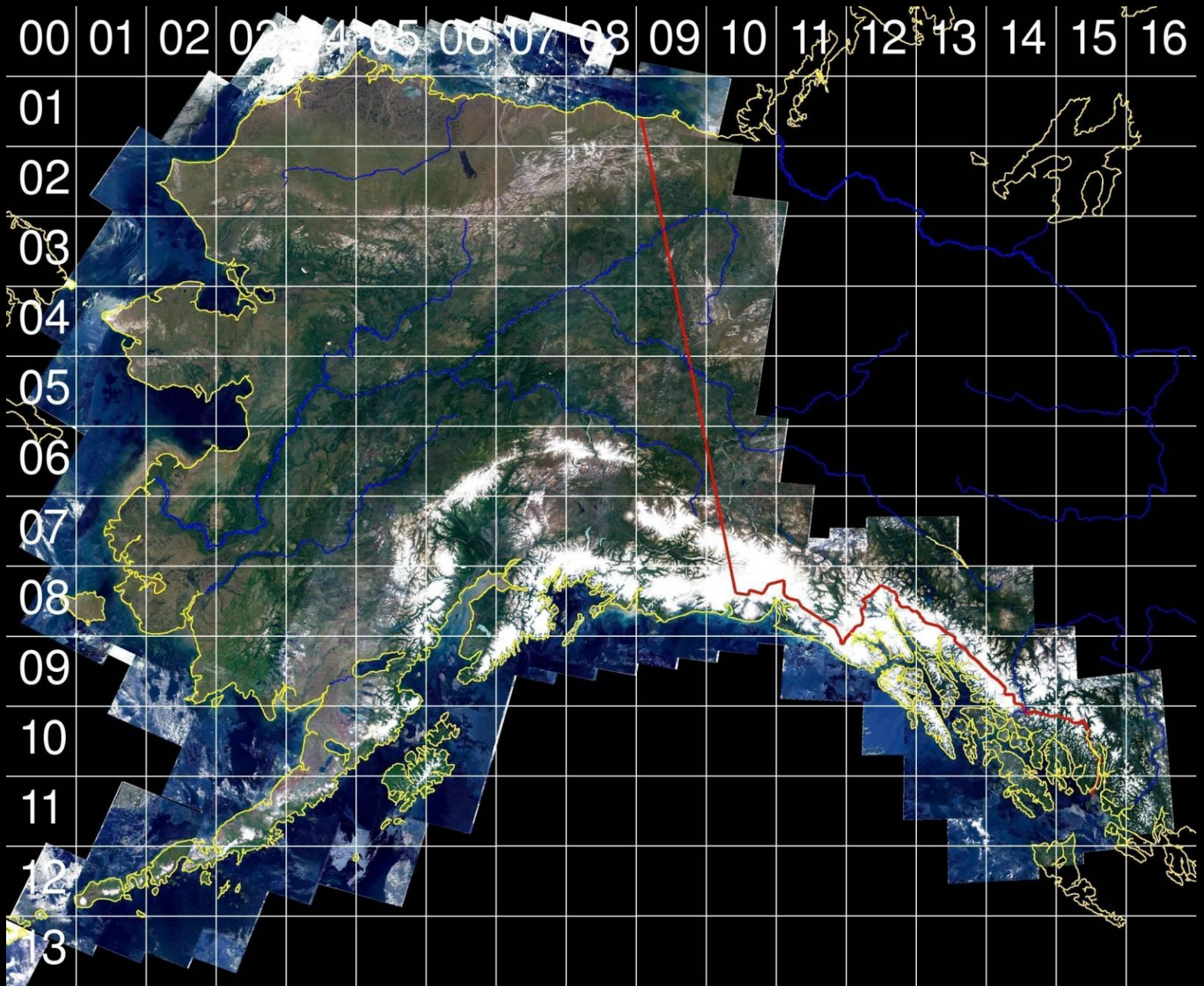
- *Similar to the NASA MODIS land products but at high spatial resolution*

- *above is what the NASA WELD funded project is seeking to achieve*


WELD Tiles
5000 x 5000 30m pixels
Albers Coordinates
Landsat
6300 x 6300 30m pixels
UTM Coordinates

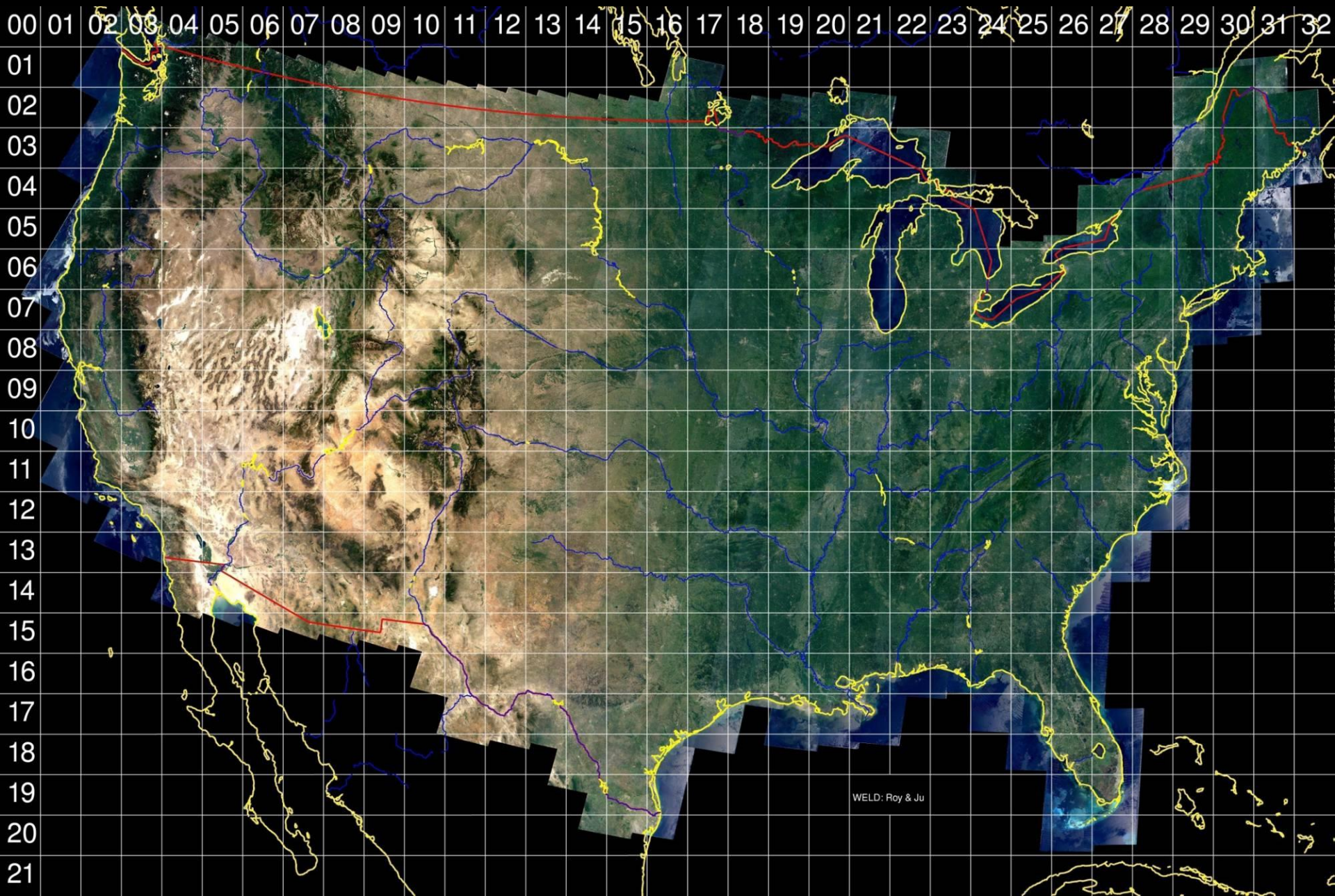
WELD Tile Map (Alaska has 162 5000x5000 30m pixel tiles in Albers)

~3,100 million 30m land pixels



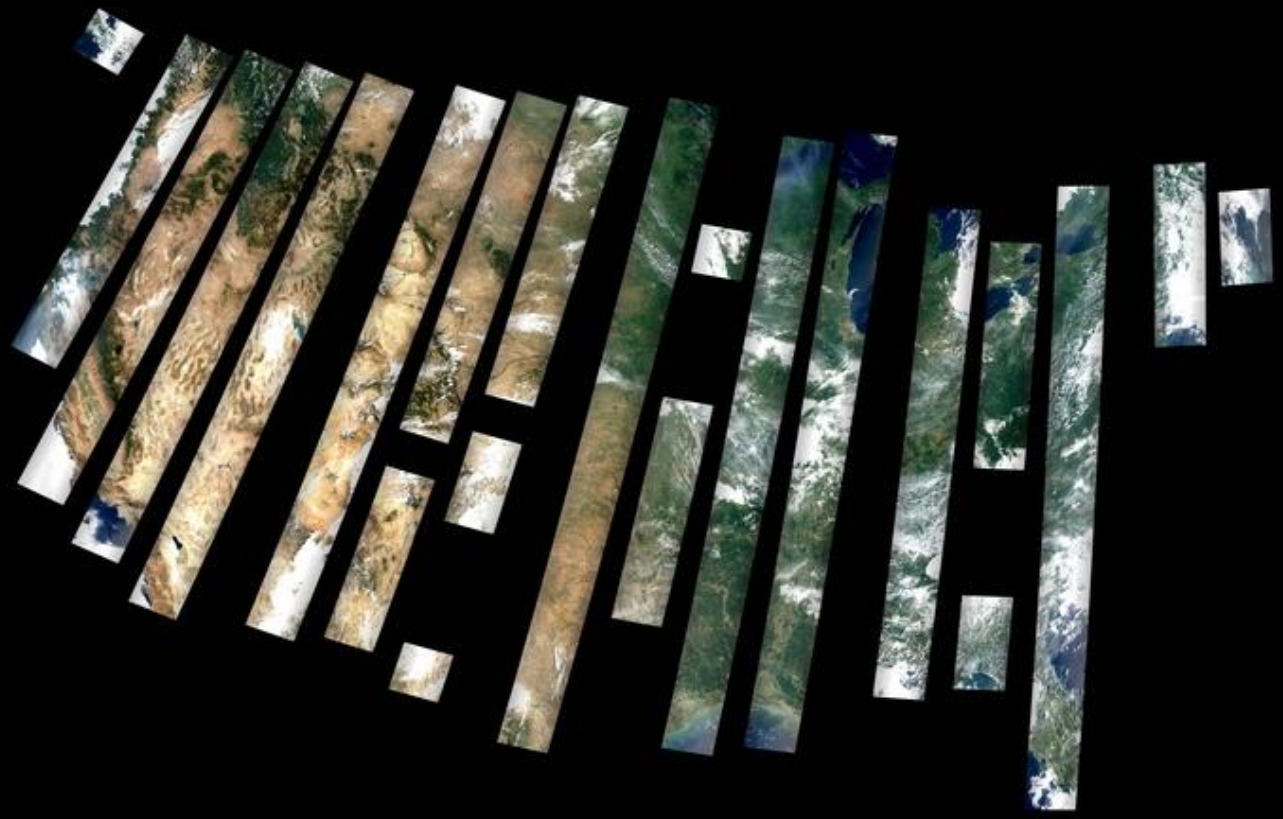
WELD Tile Map (CONUS has 501 5000 x 5000 30m pixel tiles in Albers)

~11,000 million 30m land pixels

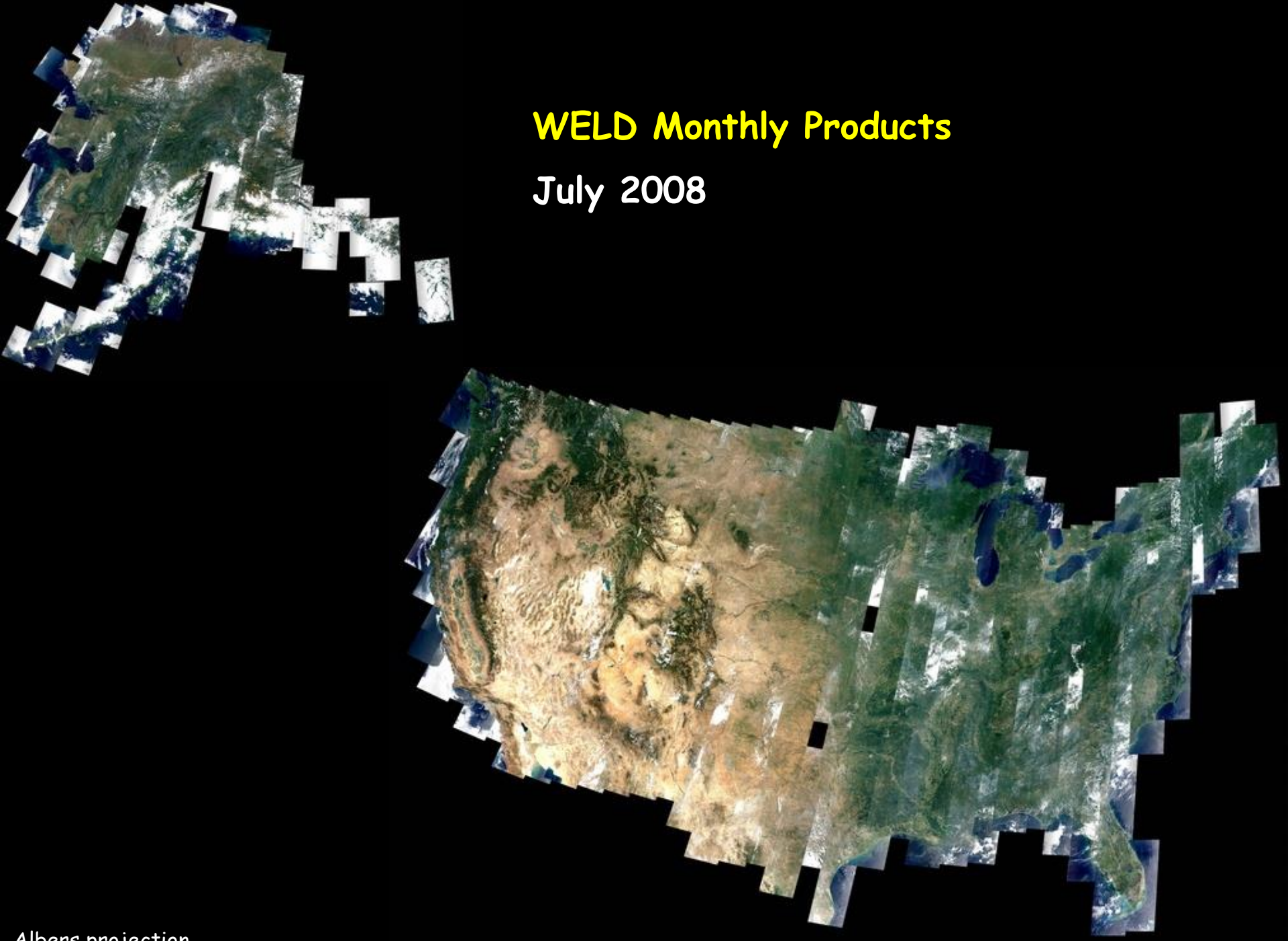


WELD Weekly Products

Week 30: July 22 – 28 2008



Albers projection


WELD Monthly Products
July 2008
Albers projection


WELD Seasonal Products
Summer (June, July, August) 2008
Albers projection

WELD Annual Products

(December 2007 – November 2008)

~ 10,000 L1T images / year

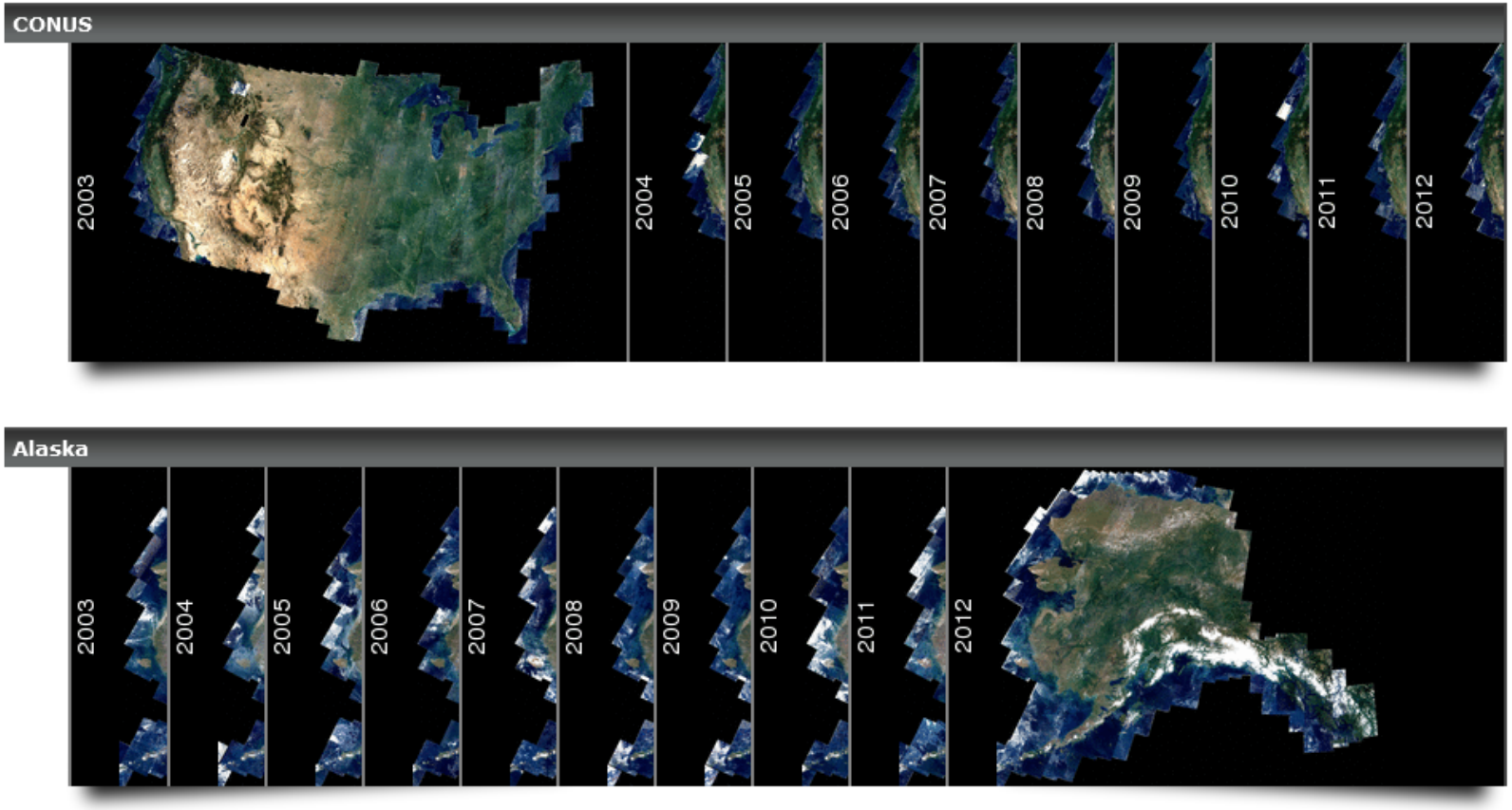
Albers projection

WELD: Web - Enabled Landsat Data

SDSU NASA USGS science for a changing world

USGS Home
Contact USGS
Search USGS

Available Years:

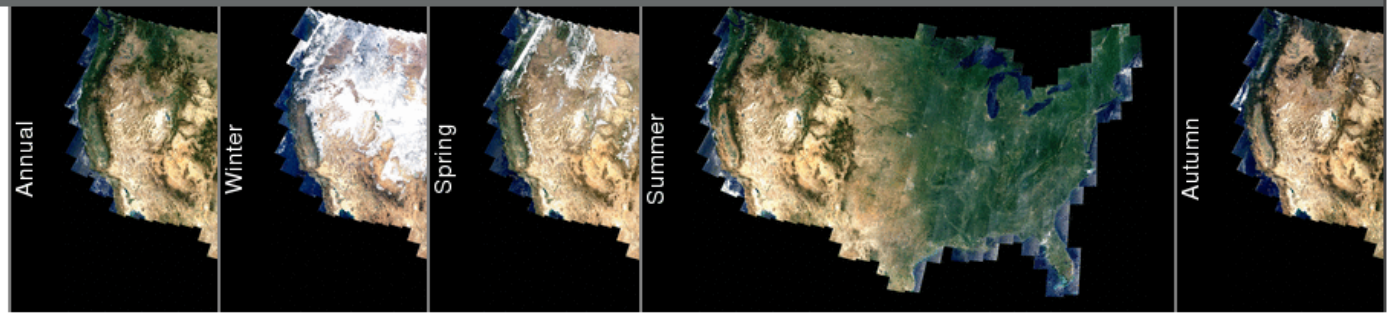


http://weld.cr.usgs.gov

CONUS 2008

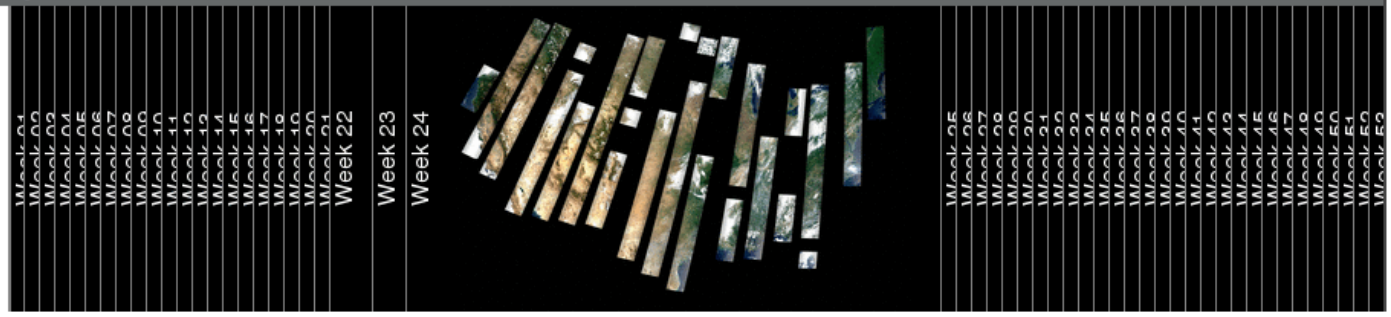
<< Home

Annual & Seasonal



Monthly

Weekly



Version 1.5 WELD Product Format (all pixels are 30m)

MODIS like format and storage approach

Science Data Set Name	Data Type	Valid Range	Scale factor	Units	Fill Value
Band1_TOA_REF	int16	-32767 -- 32767	10000	Unitless	-32768
Band2_TOA_REF	int16	-32767 -- 32767	10000	Unitless	-32768
Band3_TOA_REF	int16	-32767 -- 32767	10000	Unitless	-32768
Band4_TOA_REF	int16	-32767 -- 32767	10000	Unitless	-32768
Band5_TOA_REF	int16	-32767 -- 32767	10000	Unitless	-32768
Band61_TOA_BT	int16	-32767 -- 32767	100	Degrees Celsius	-32768
Band62_TOA_BT	int16	-32767 -- 32767	100	Degrees Celsius	-32768
Band7_TOA_REF	int16	-32767 -- 32767	10000	Unitless	-32768
NDVI_TOA	int16	-10000 -- 10000	10000	Unitless	-32768
Day_Of_Year	int16	1 -- 366	1	Day	0
Saturation_Flag	uint8	0 -- 255	1	Unitless	None
DT_Cloud_State	uint8	0, 1, 2, 200	1	Unitless	255
ACCA_State	uint8	0, 1	1	Unitless	255
Num_Of_Observations	uint8	0 -- 255	1	Unitless	None

- Format designed to be easy to use for science and applications

Vector

Zoom In (or double click)

Zoom Out (or mouse wheel)

Next Period

Previous Period

Order Coordinates

Longitude/latitude

Albers

Hold the shift button & drag the mouse to define your order area, or enter the area coordinates below

Note: In using Long/Lat the coordinates refer to the SW and NE corners of the area

North: 41.6

South: 40.8

West: -113.3

East: -110.6

Order Data

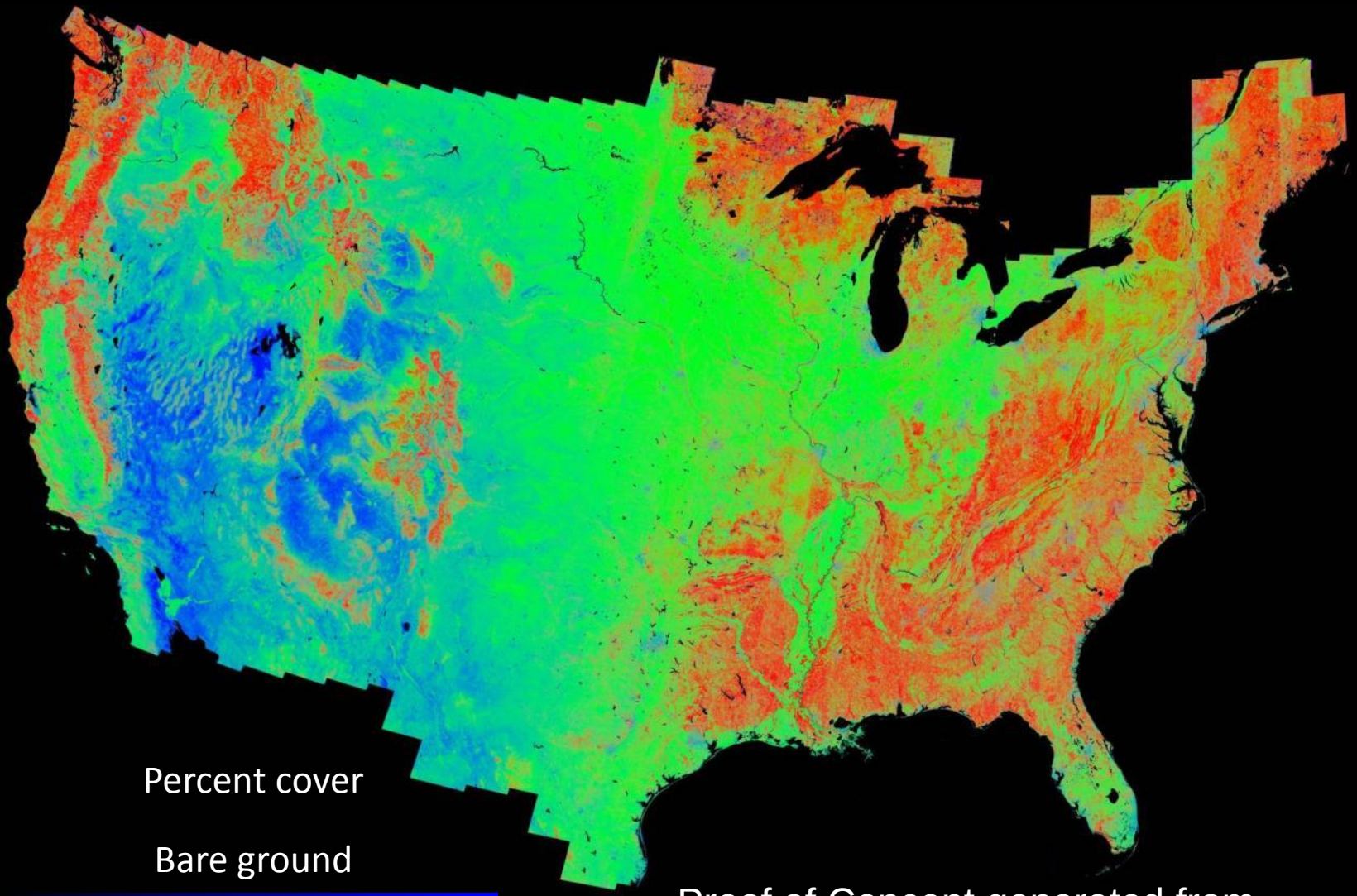
Click the left button to define a single pixel time series dump, or enter the pixel coordinates below

North: 40.08235317

West: -113.48454620

Order Pixel Time series

WELD derived 30m Vegetation Continuous field product



Percent cover

Bare ground

Grass/shrubs/moss

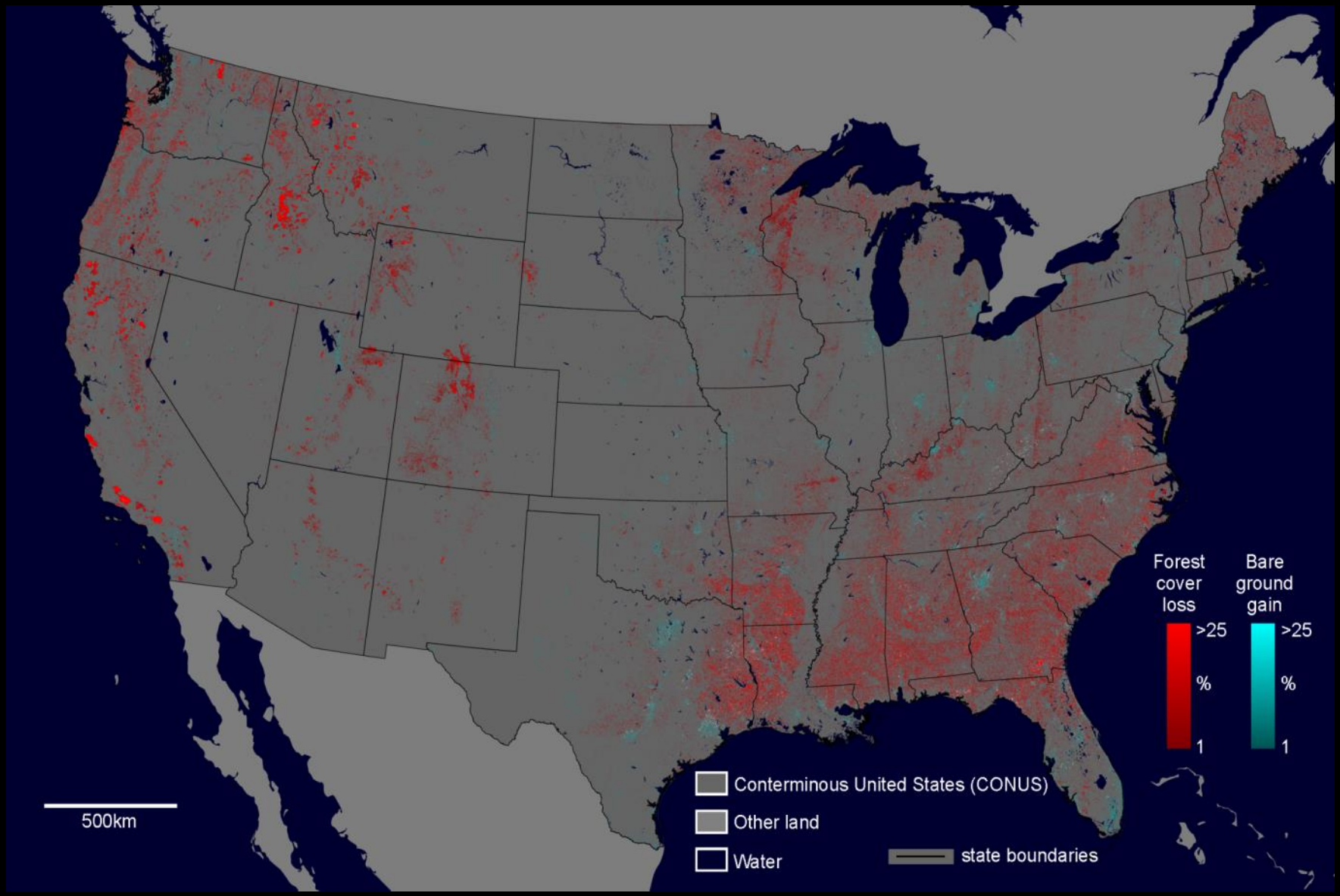
0% 100%

Trees

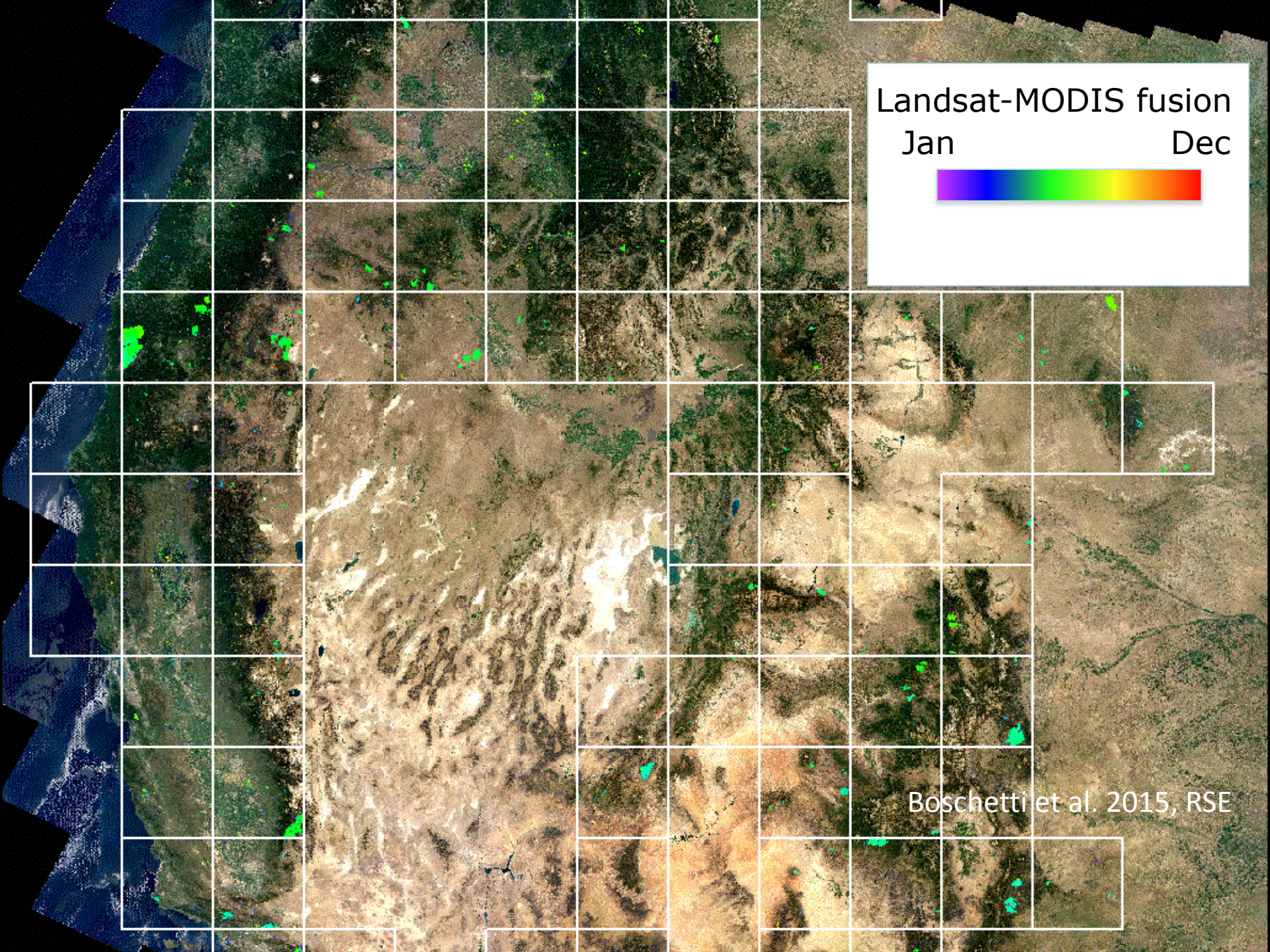
Proof of Concept generated from 2008 monthly, seasonal and annual WELD composites

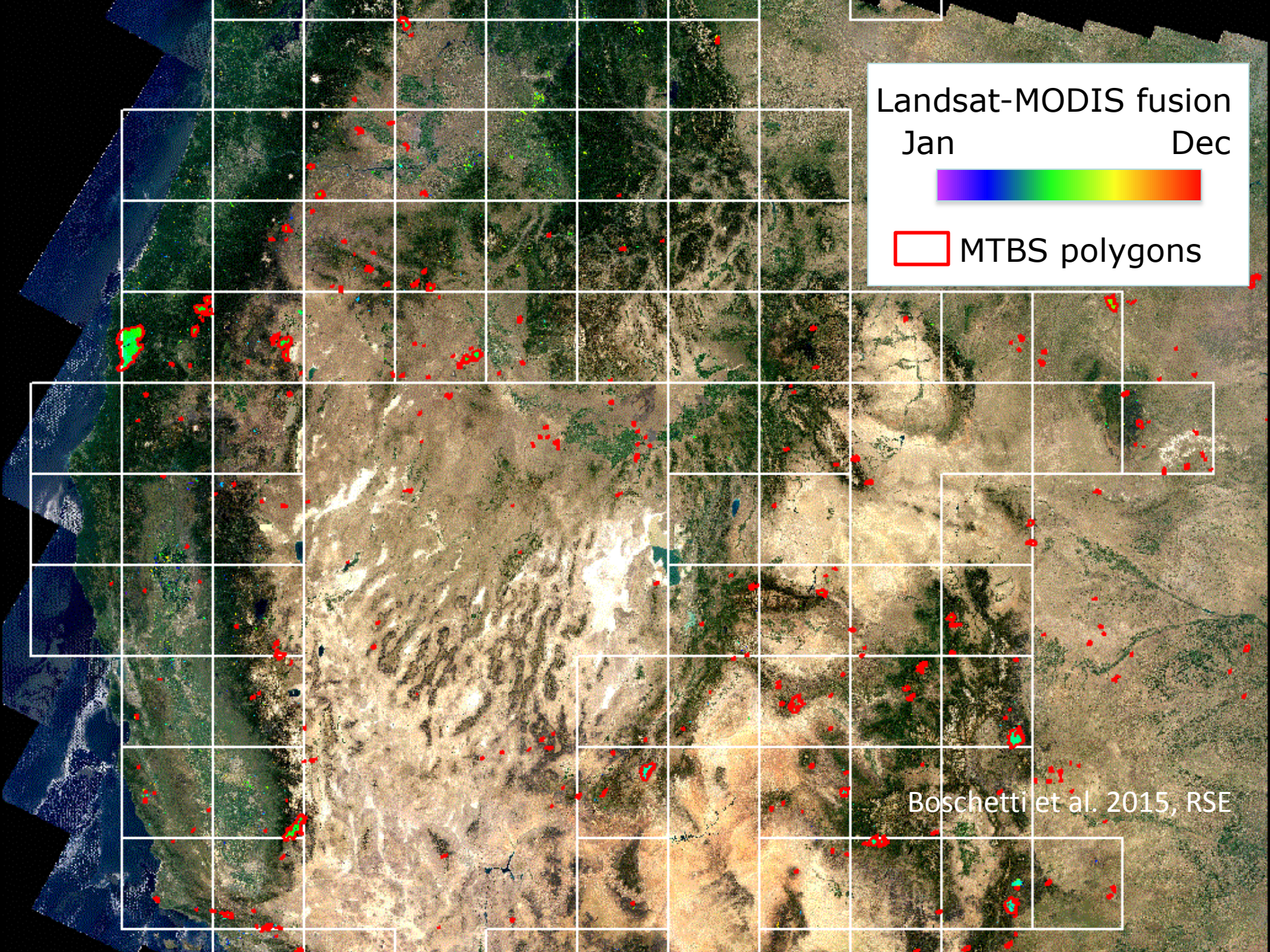
Matt Hansen et al. RSL 2011

WELD derived 30m 5-year forest cover loss and bare ground gain product: 2006-2010



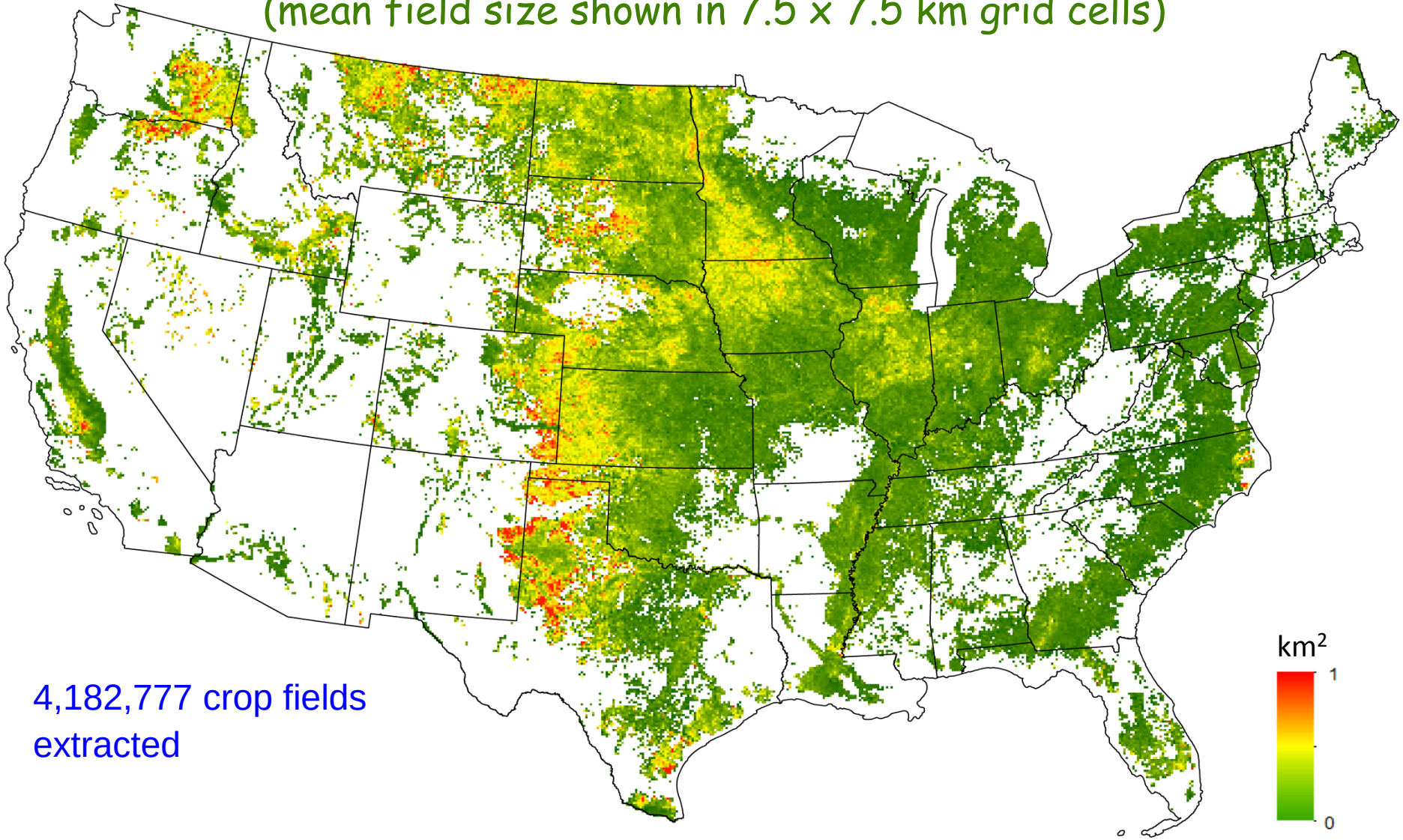
Matt Hansen et al. RSENV 2014


Landsat-MODIS fusion
Jan
Dec
Boschetti et al. 2015, RSE


Landsat-MODIS fusion
Jan
Dec
MTBS polygons
Boschetti et al. 2015, RSE

2010 CONUS crop field size map

(mean field size shown in 7.5 x 7.5 km grid cells)

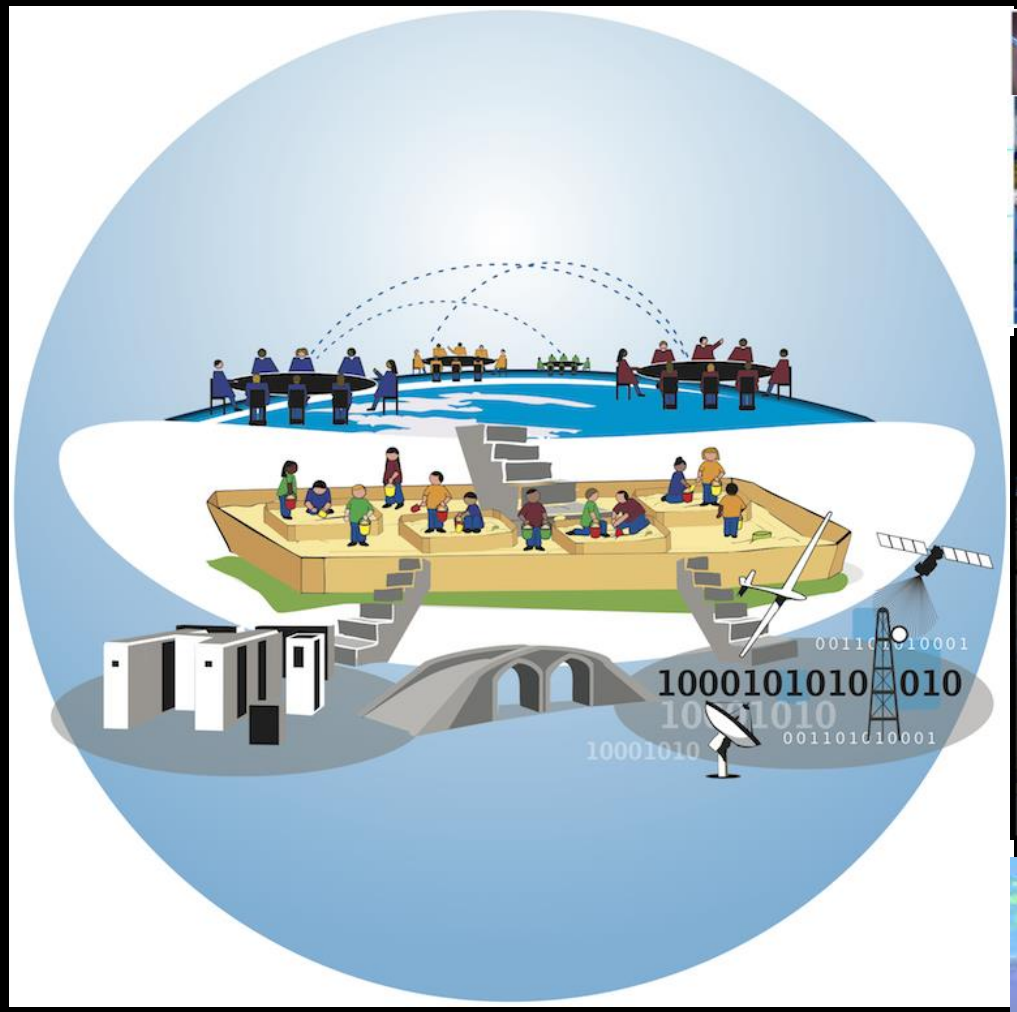


4,182,777 crop fields extracted

derived from all 13,666 WELD processed Landsat 5 and 7 scenes available in the U.S. Landsat archive for 12 months

Yan and Roy, 2016, *RSE*

Global WELD code run on NASA Earth Exchange (NEX)



- **2 PB on-line storage, 50PB tape storage**
- **512 cores dedicated cores**
- **200,000 total available cores on Pleiades**

COLLABORATION (over 400 members)

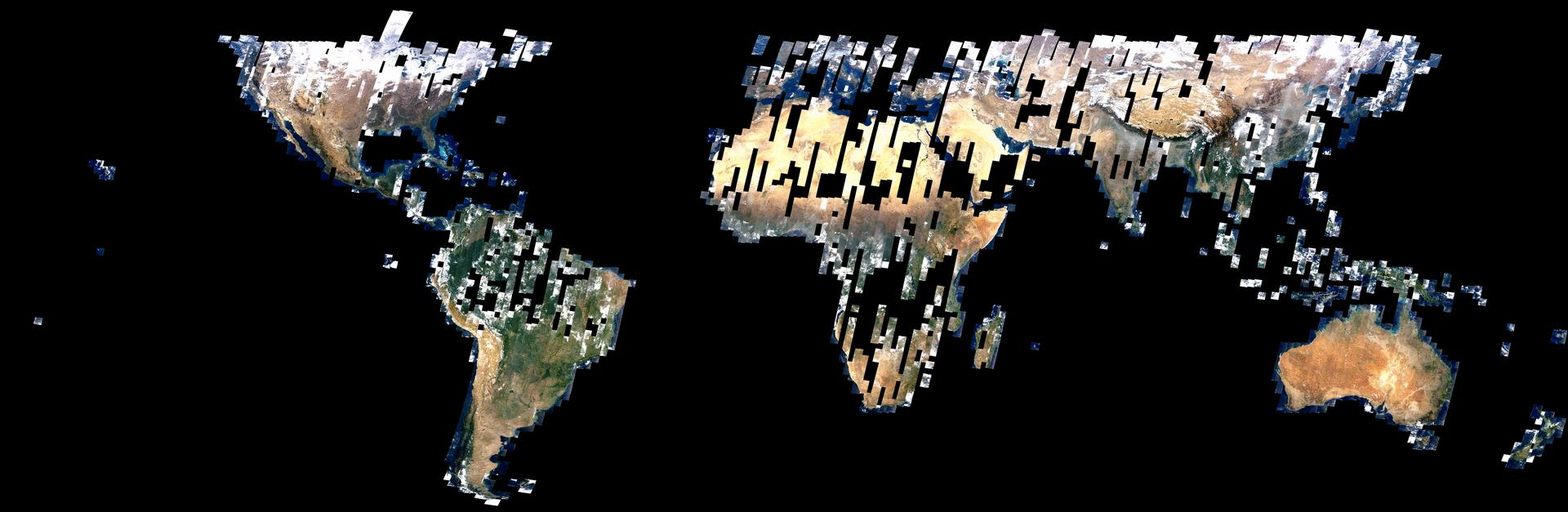
Pleiades

NASA's fastest supercomputer

COMPUTING (180,000 cores)

Data Repository (over 600TB of data)

3 Years global 30m monthly & annual WELD Version 2.2 products available



30m Global WELD NEX

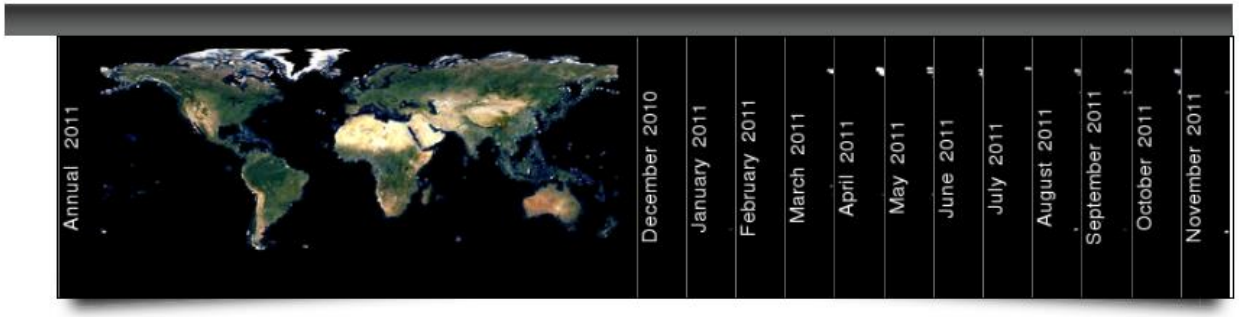
Month 12 2008

GeoTiff format products: http://globalweld.cr.usgs.gov

HDF format products: http://globalweld.cr.usgs.gov/collections

Climate year 2011

<< Home



Climate year 2010

Climate year 2009

Notice: To obtain large amounts of WELD data, please use the DAAC2Disk Download Manager to submit your request. This will ensure your order will process through our system efficiently. Please see the DAAC2Disk User Guide for more information and direct any questions to LP DAAC User Services.

Collections

74TB
312,000 files

** The text files were created to be used with the DAAC2Disk tool. This tool facilitates the downloading of large amounts of data.*

Annual (2009, 2010, 2011)				
Folder Name	**Type**	**# of files**	**Size**	**Text File**
weld.global.annual.2009	Global Annual 2009	8,050	3,026,904 MB	weld.global.annual.2009.txt
weld.global.annual.2010	Global Annual 2010	8,023	2,975,832 MB	weld.global.annual.2010.txt
weld.global.annual.2011	Global Annual 2011	8,003	2,943,370 MB	weld.global.annual.2011.txt
	Totals for Annuals	**24,076**	**8,946,106 MB**	

2009				
Folder Name	**Type**	**# of files**	**Size**	**Text File**
weld.global.month01.2009	Global Month 1	5,770	1,451,543 MB	weld.global.month01.2009.txt
weld.global.month02.2009	Global Month 2	6,197	1,528,338 MB	weld.global.month02.2009.txt
weld.global.month03.2009	Global Month 3	7,153	1,835,942 MB	weld.global.month03.2009.txt
weld.global.month04.2009	Global Month 4	7,233	1,777,753 MB	weld.global.month04.2009.txt
weld.global.month05.2009	Global Month 5	7,245	1,854,749 MB	weld.global.month05.2009.txt
weld.global.month06.2009	Global Month 6	7,104	1,953,828 MB	weld.global.month06.2009.txt
weld.global.month07.2009	Global Month 7	6,884	1,896,111 MB	weld.global.month07.2009.txt
weld.global.month08.2009	Global Month 8	7,018	1,940,278 MB	weld.global.month08.2009.txt
weld.global.month09.2009	Global Month 9	7,178	1,990,522 MB	weld.global.month09.2009.txt
weld.global.month10.2009	Global Month 10	7,095	1,858,060 MB	weld.global.month10.2009.txt
weld.global.month11.2009	Global Month 11	6,278	1,657,394 MB	weld.global.month11.2009.txt
weld.global.month12.2008	Global Month 12	5,511	1,341,593 MB	weld.global.month12.2008.txt
	Totals for Months	**80,666**	**21,086,111 MB**	

2010				
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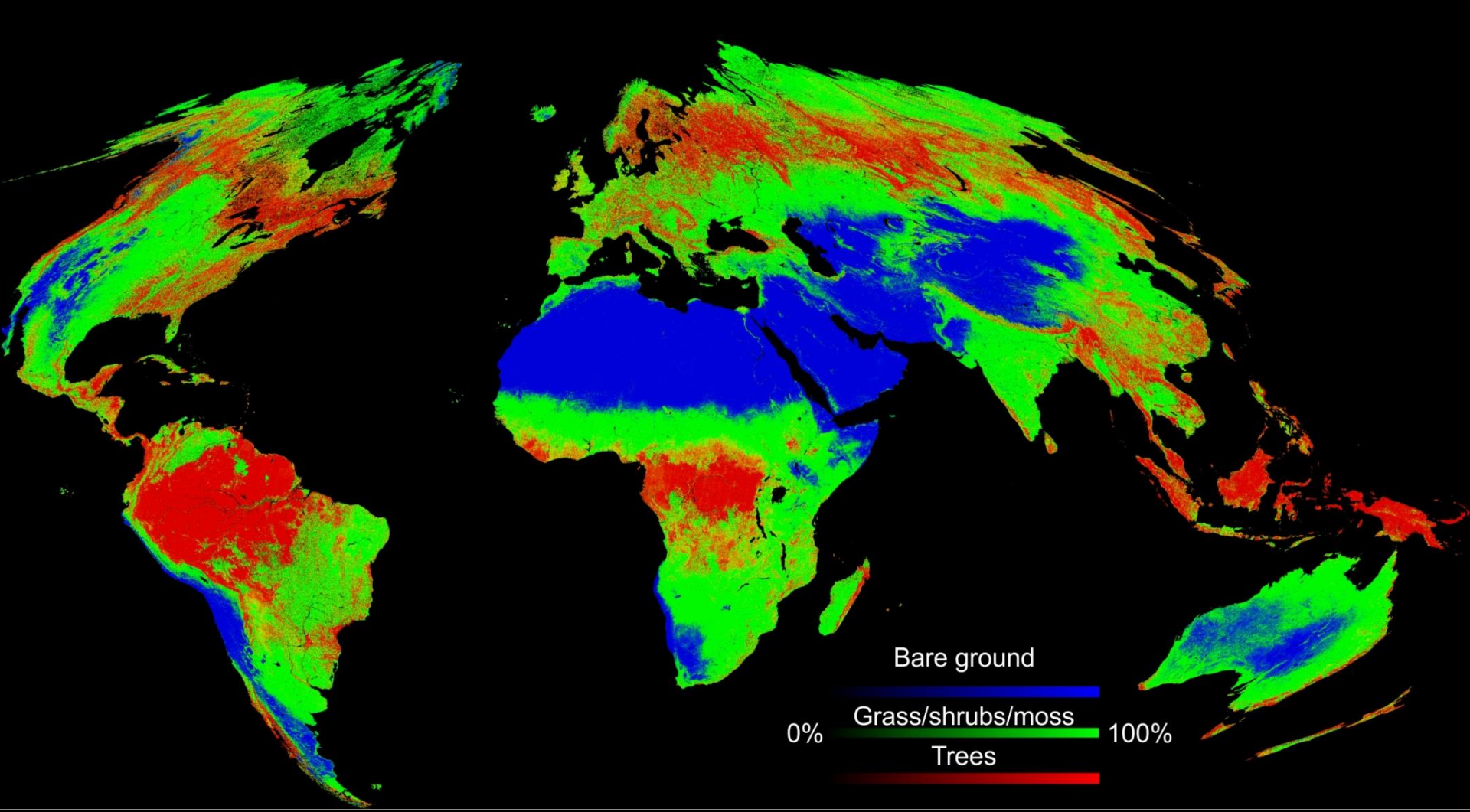
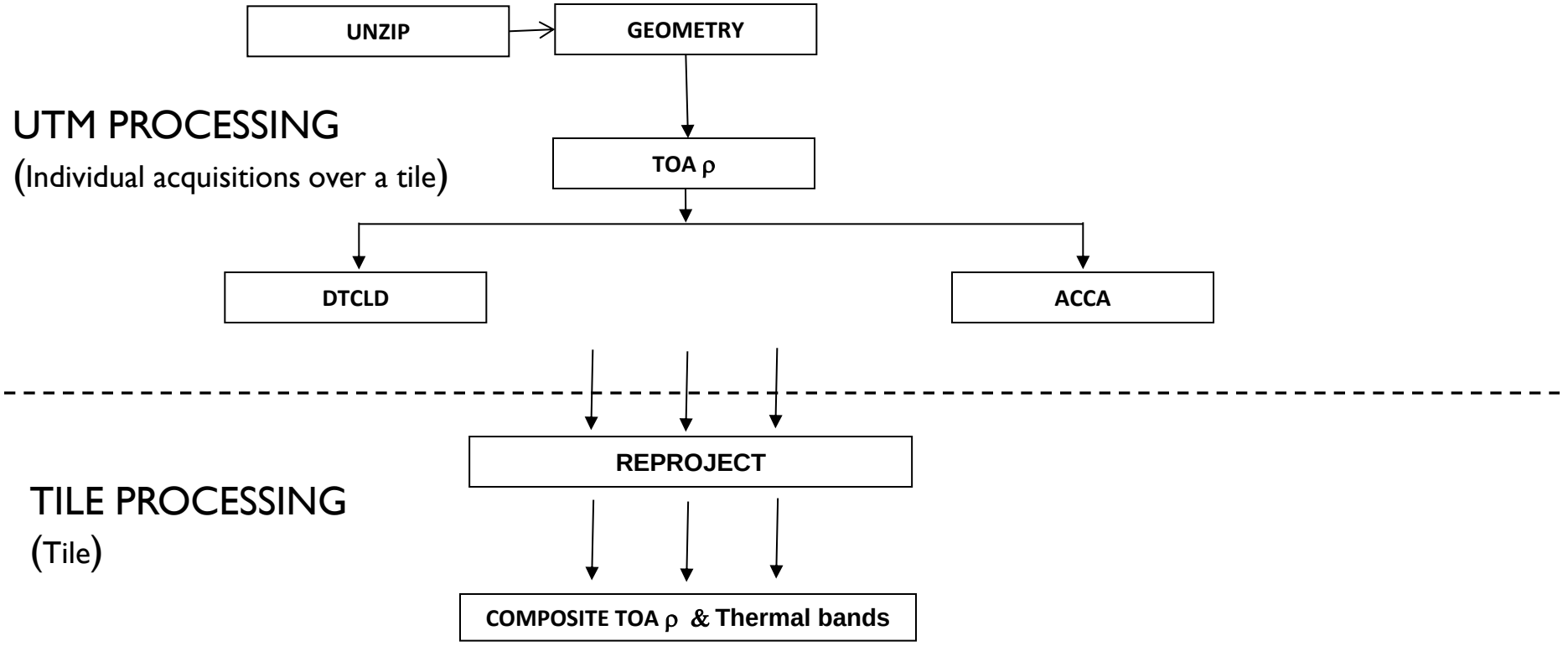
weld.global.month01.2010	Global Month 1	5,605	1,396,719 MB	weld.global.month01.2010.txt
weld.global.month02.2010	Global Month 2	6,117	1,445,984 MB	weld.global.month02.2010.txt

Global Version 2.2 WELD derived 30m Vegetation Continuous field product

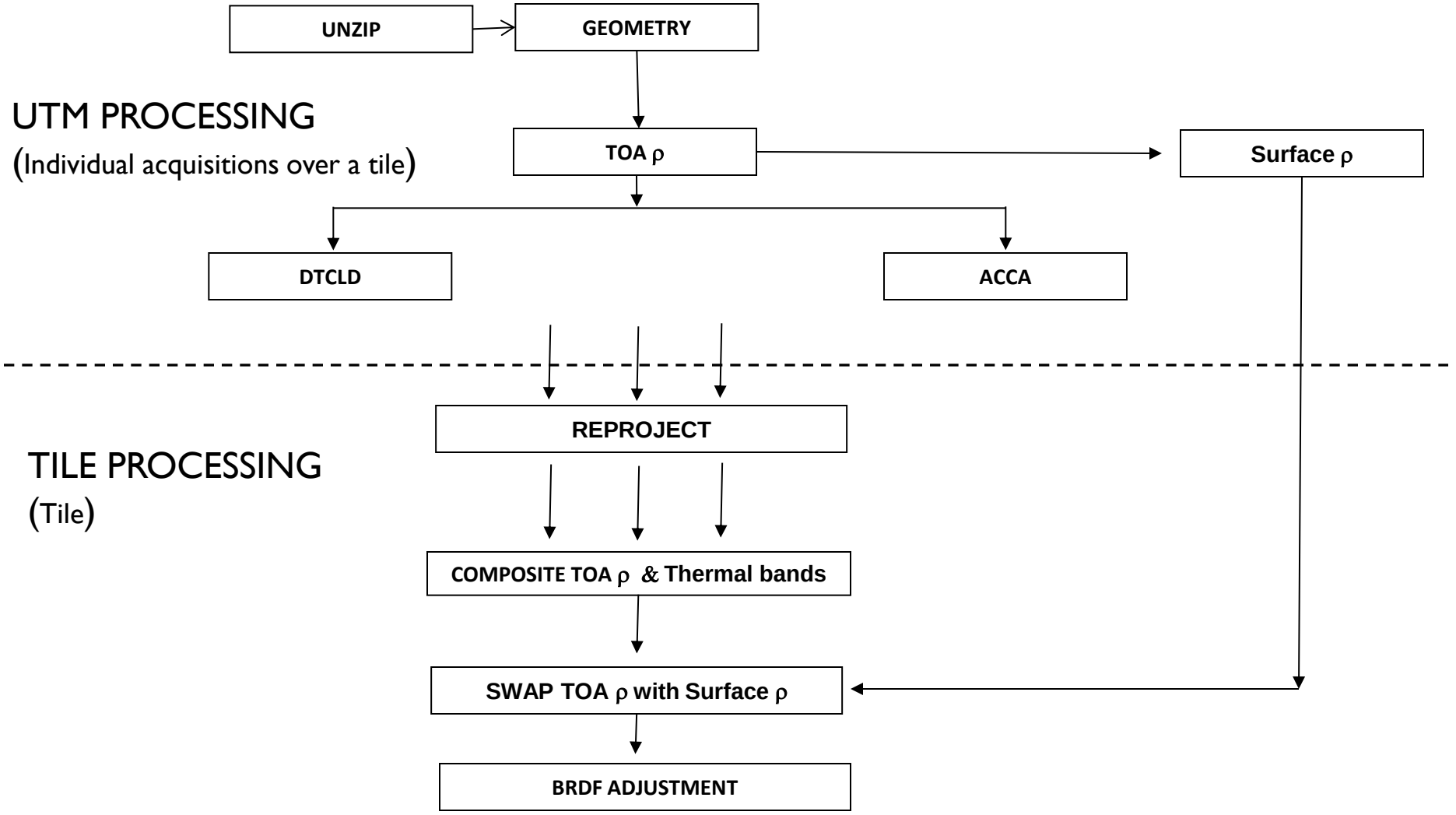


(Matt Hansen, Peter Potapov et al.)

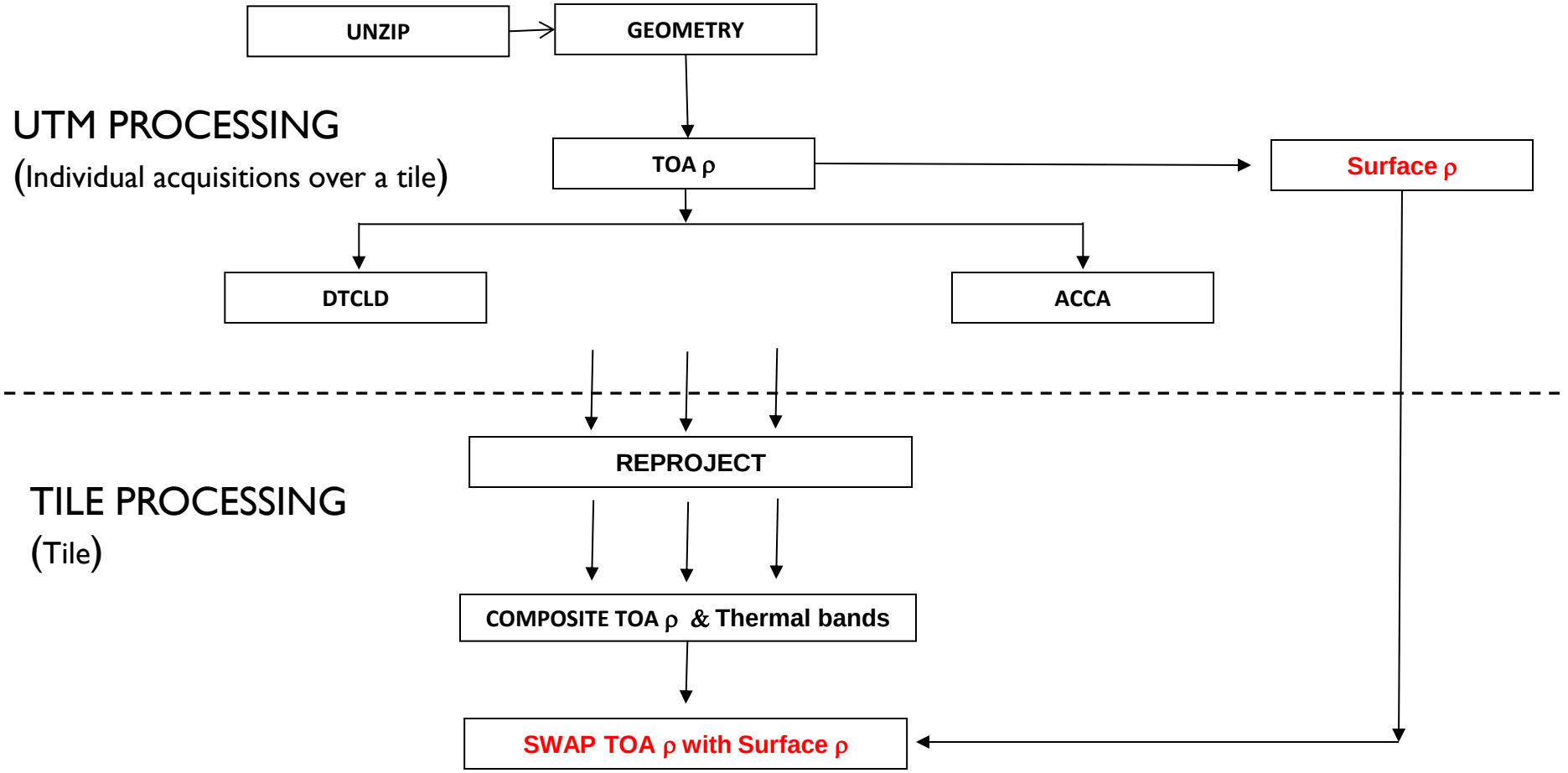
Overview of Global Version 2.2 WELD Processing Sequence

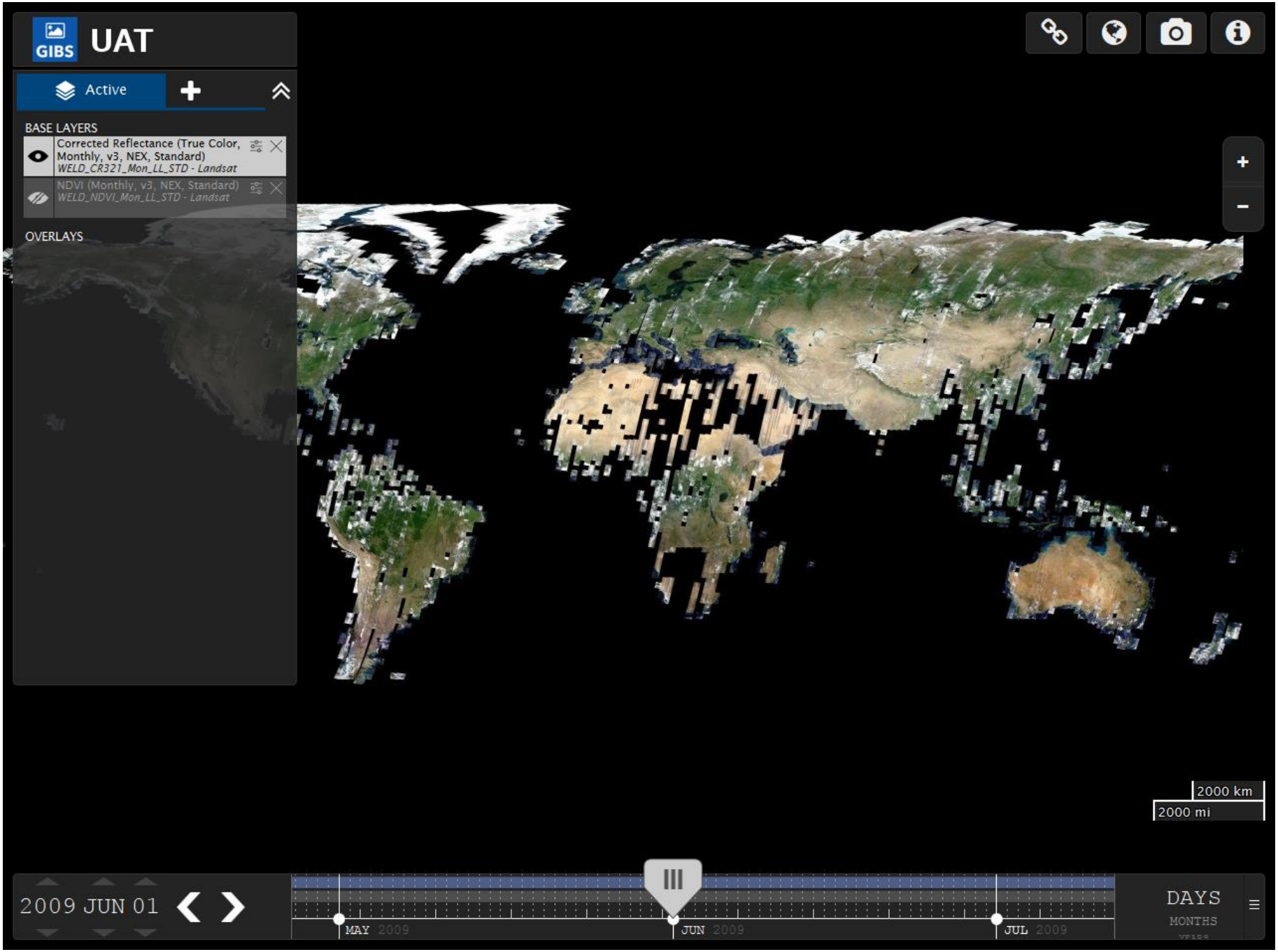


Overview of Global Version 3.0 WELD Processing Sequence

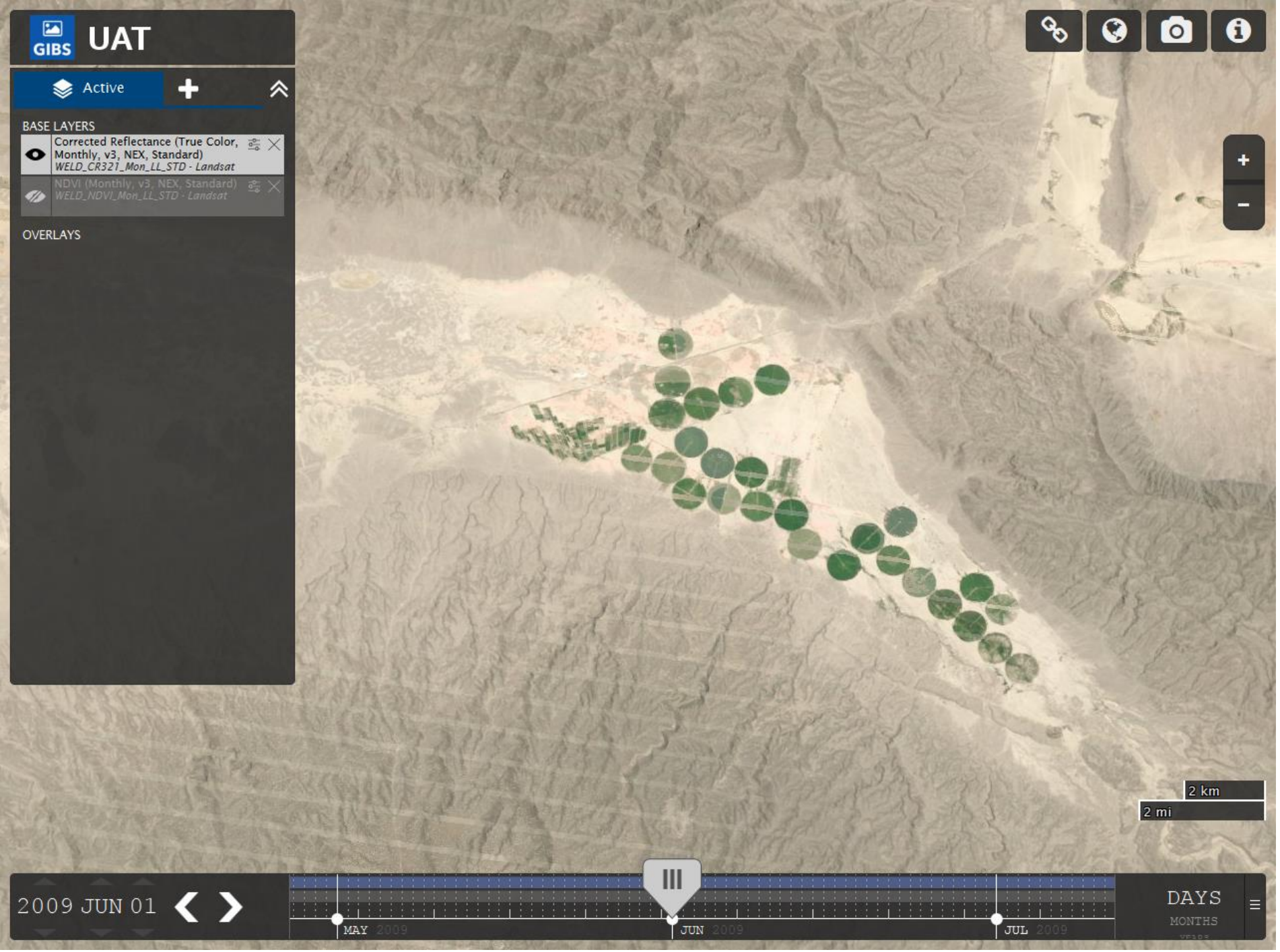


Overview of Global Version 3.0 WELD Processing Sequence




GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
2000 km
2000 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS


GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
1000 m
5000 ft
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS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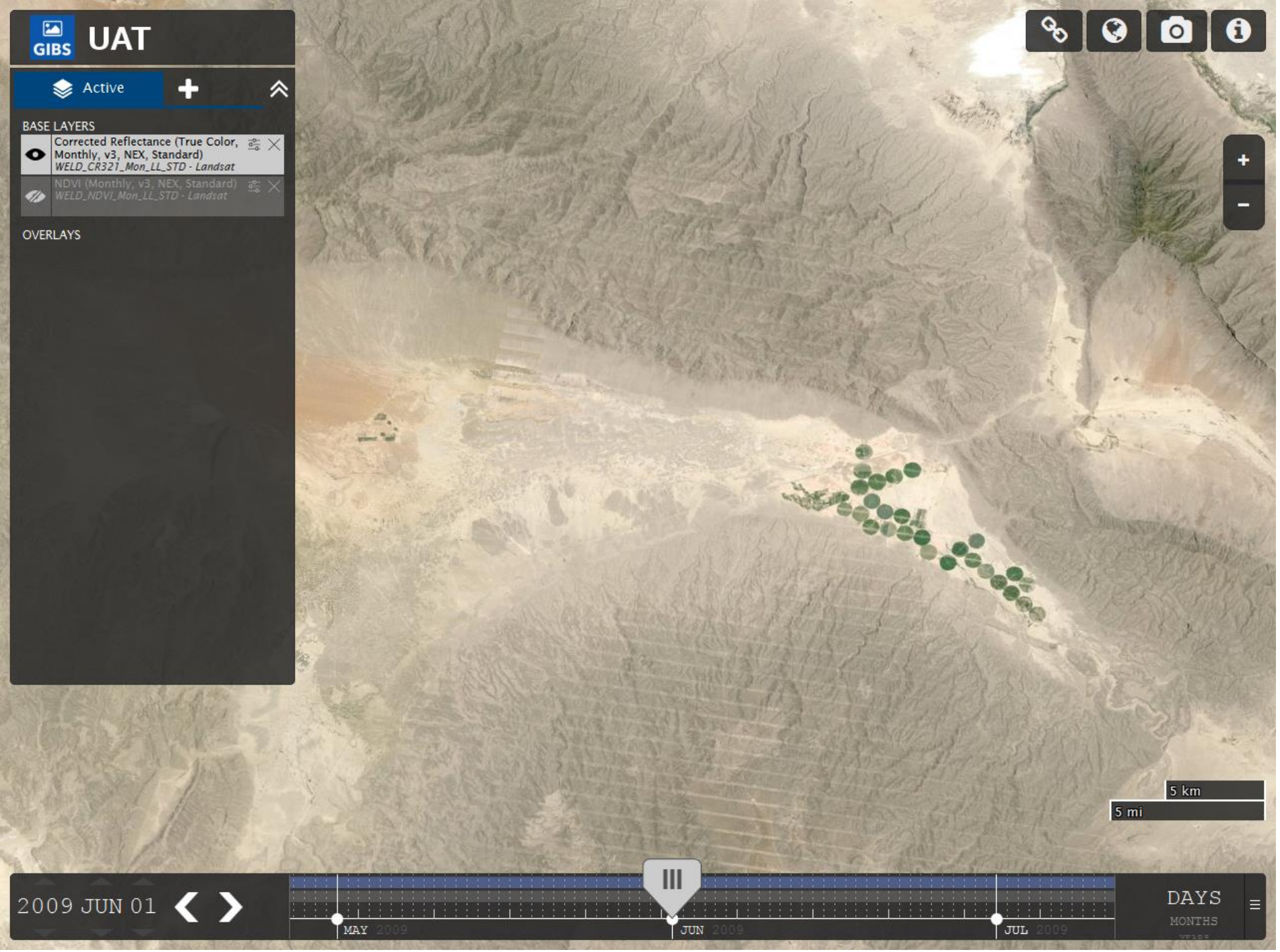
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
2 km
2 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS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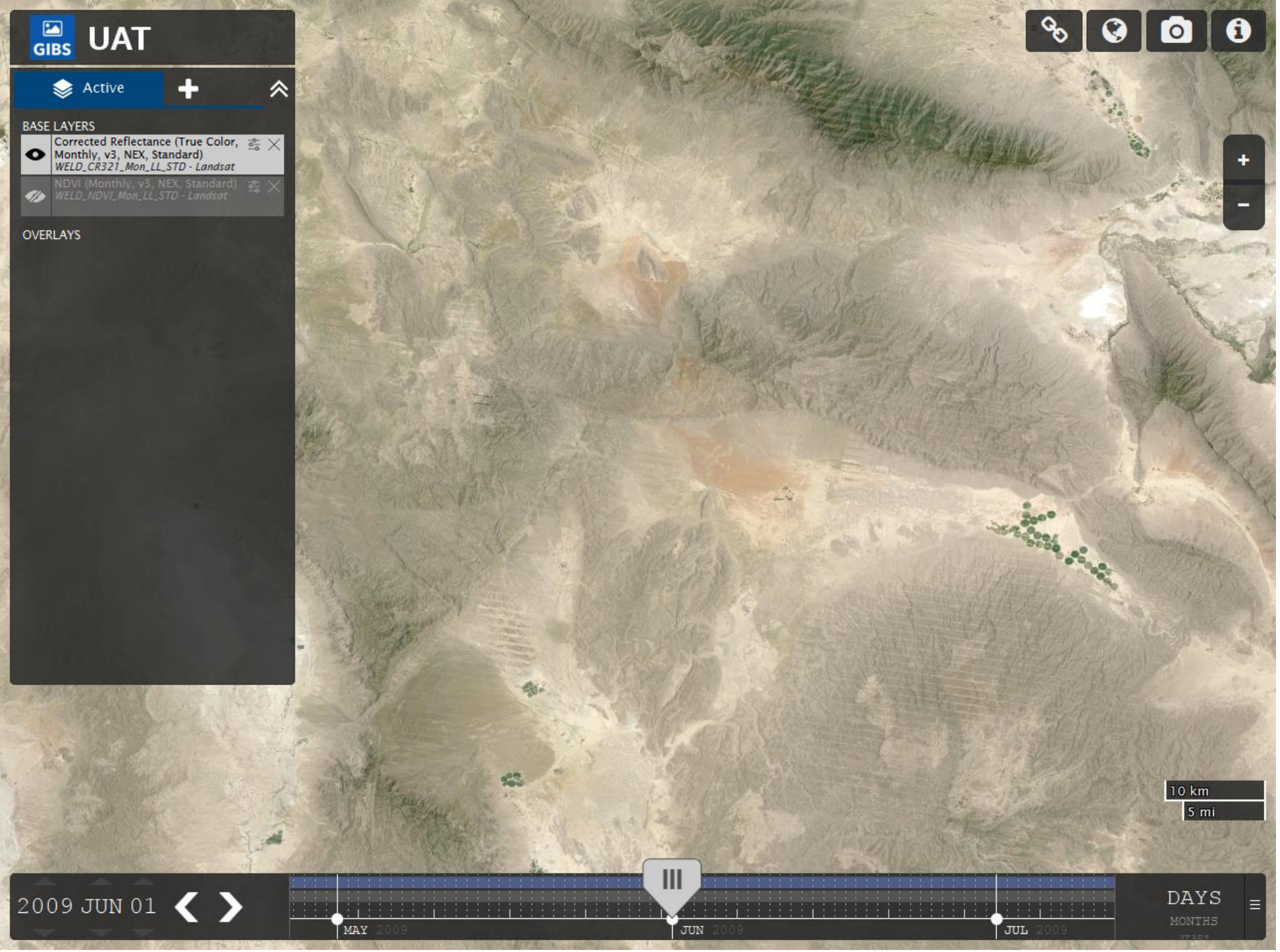
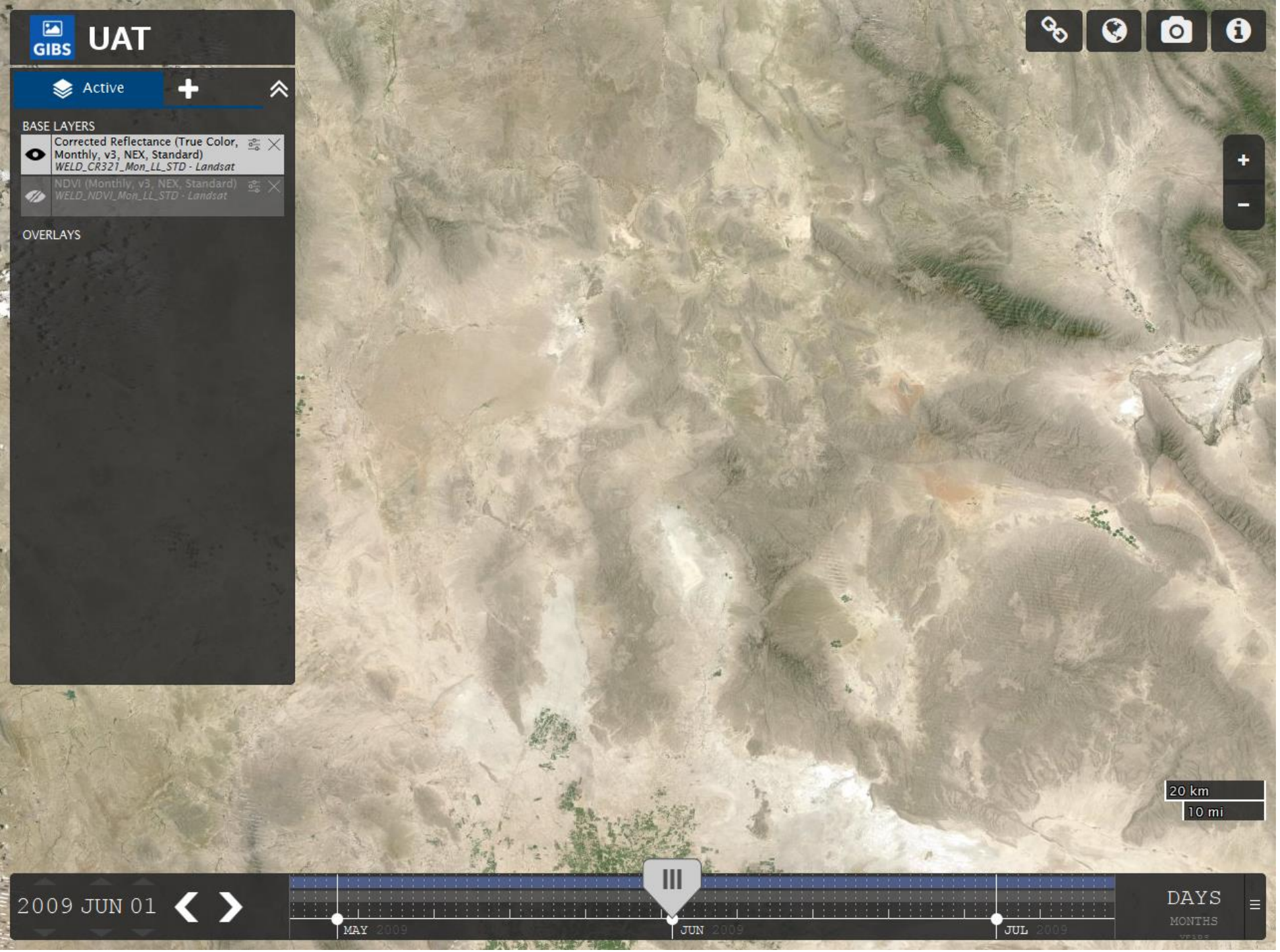
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
5 km
5 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS


GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
10 km
5 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS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20 km
10 mi
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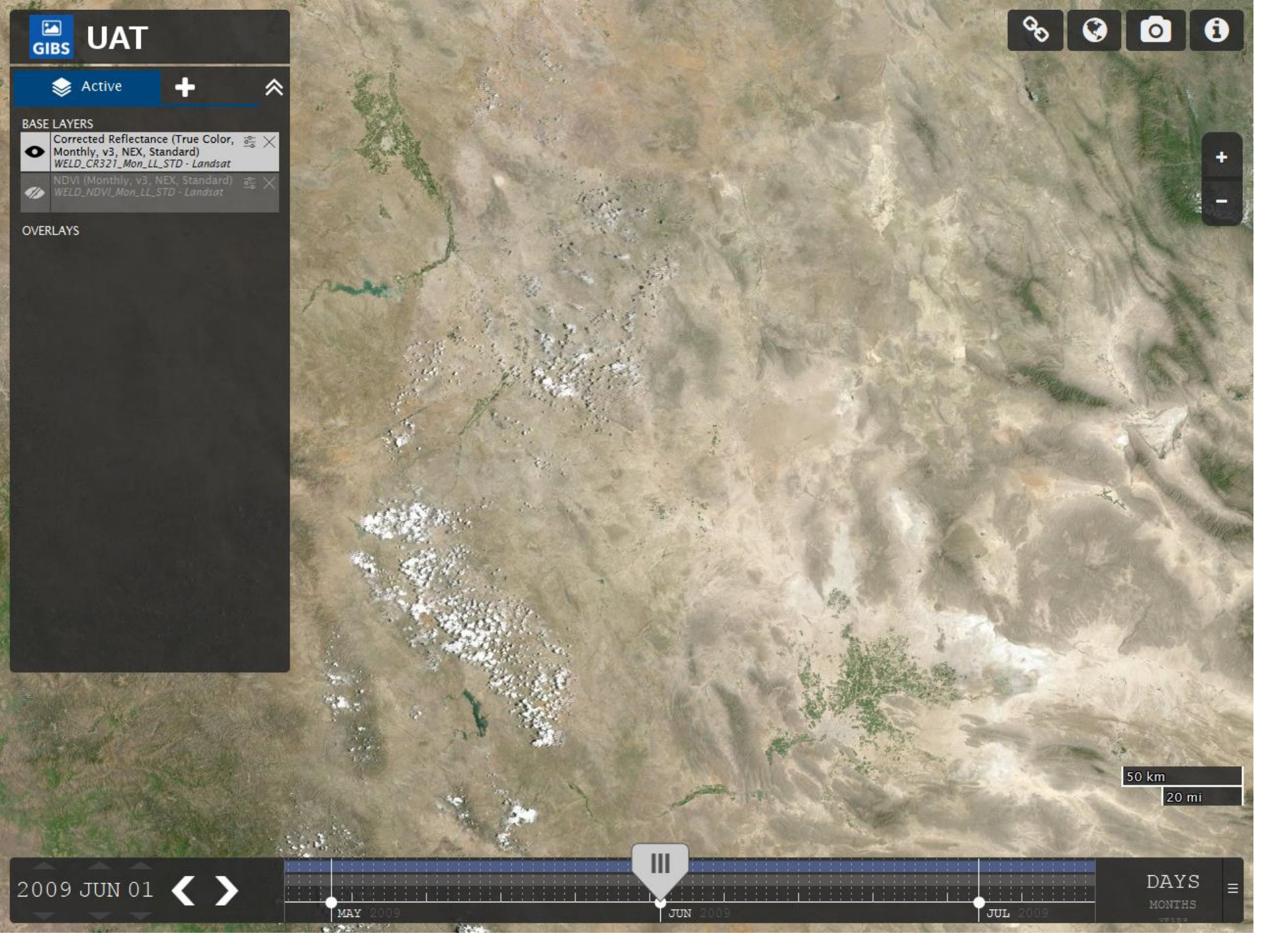
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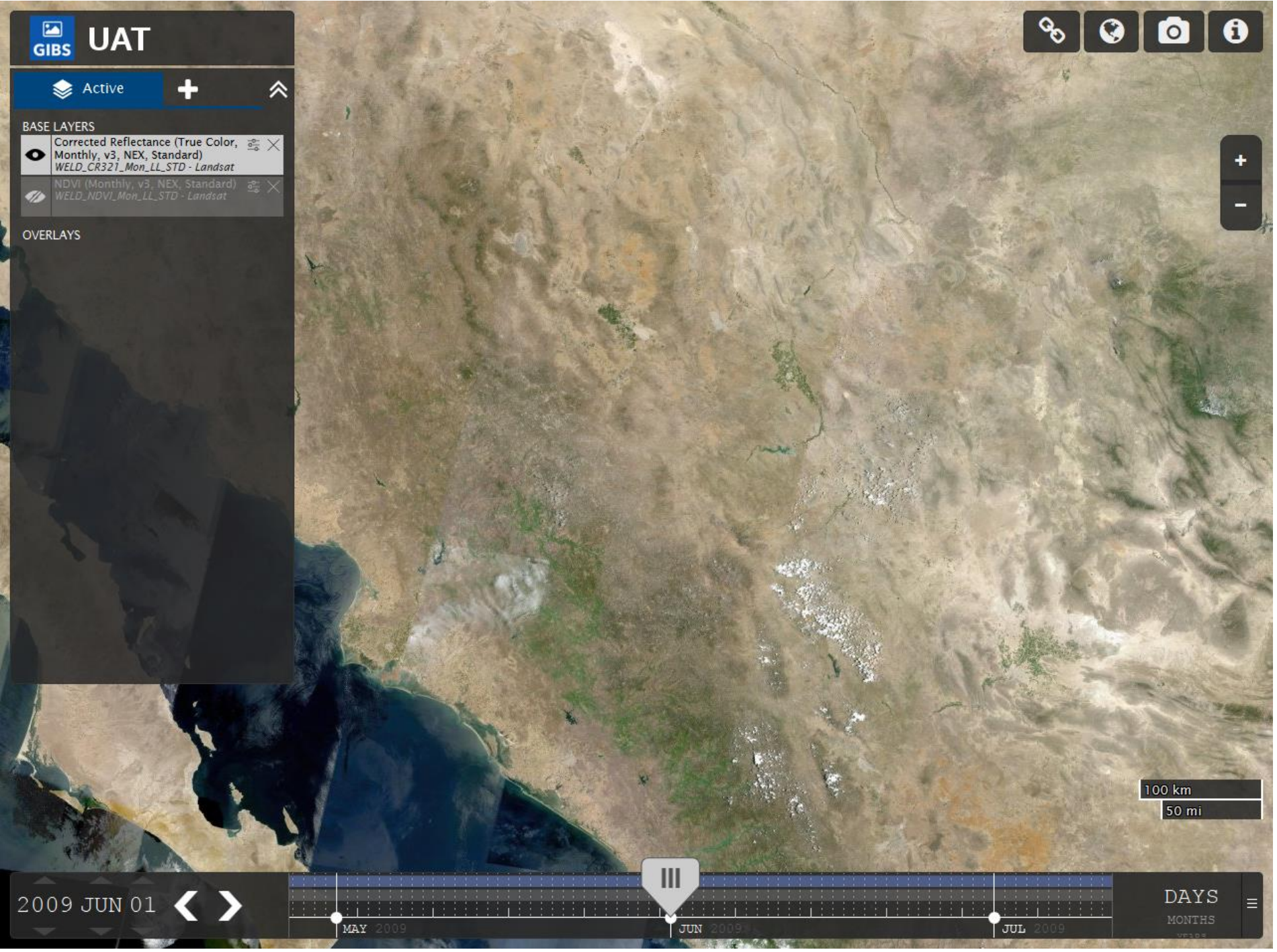
OVERLAYS
50 km
20 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS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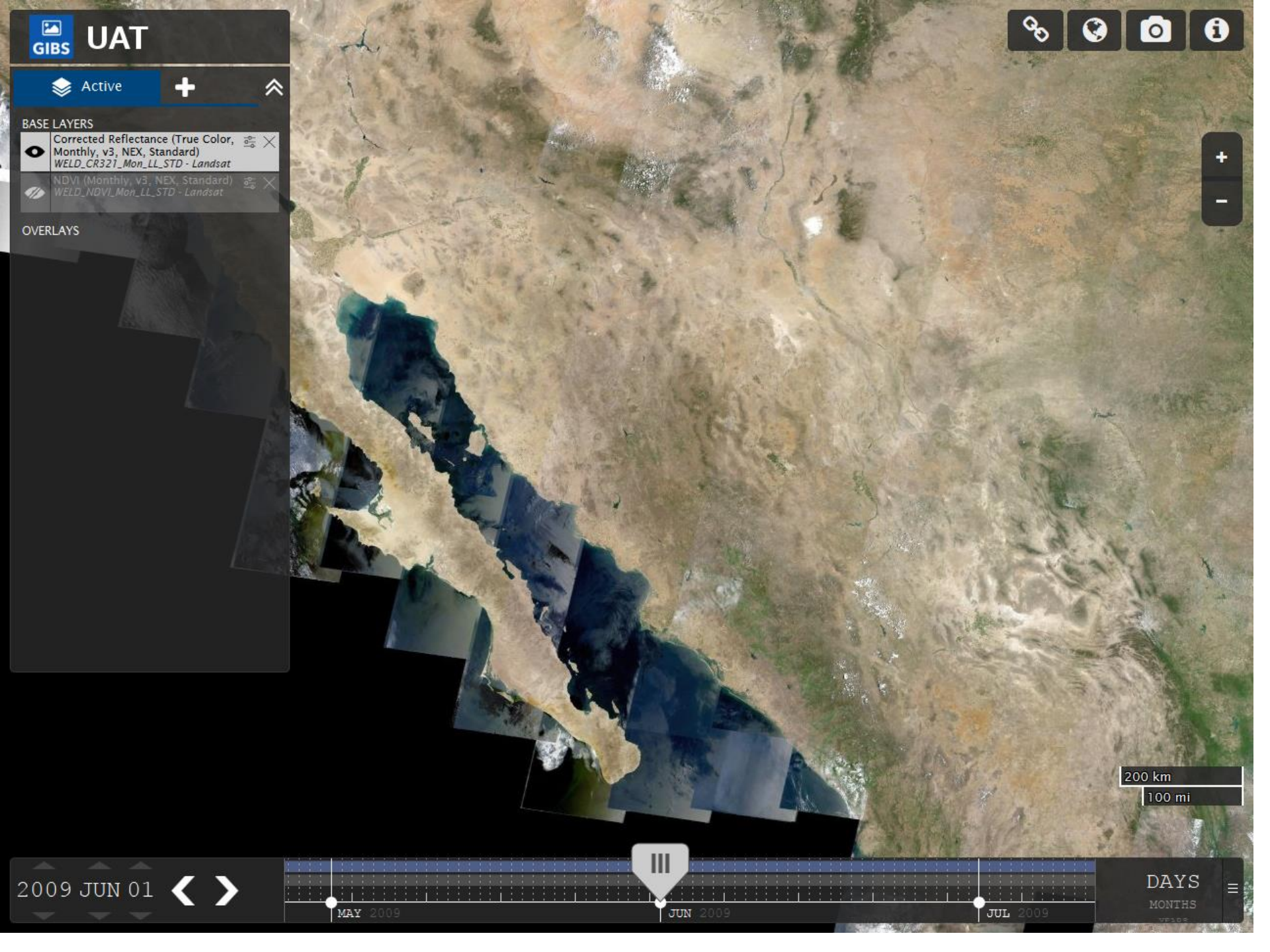
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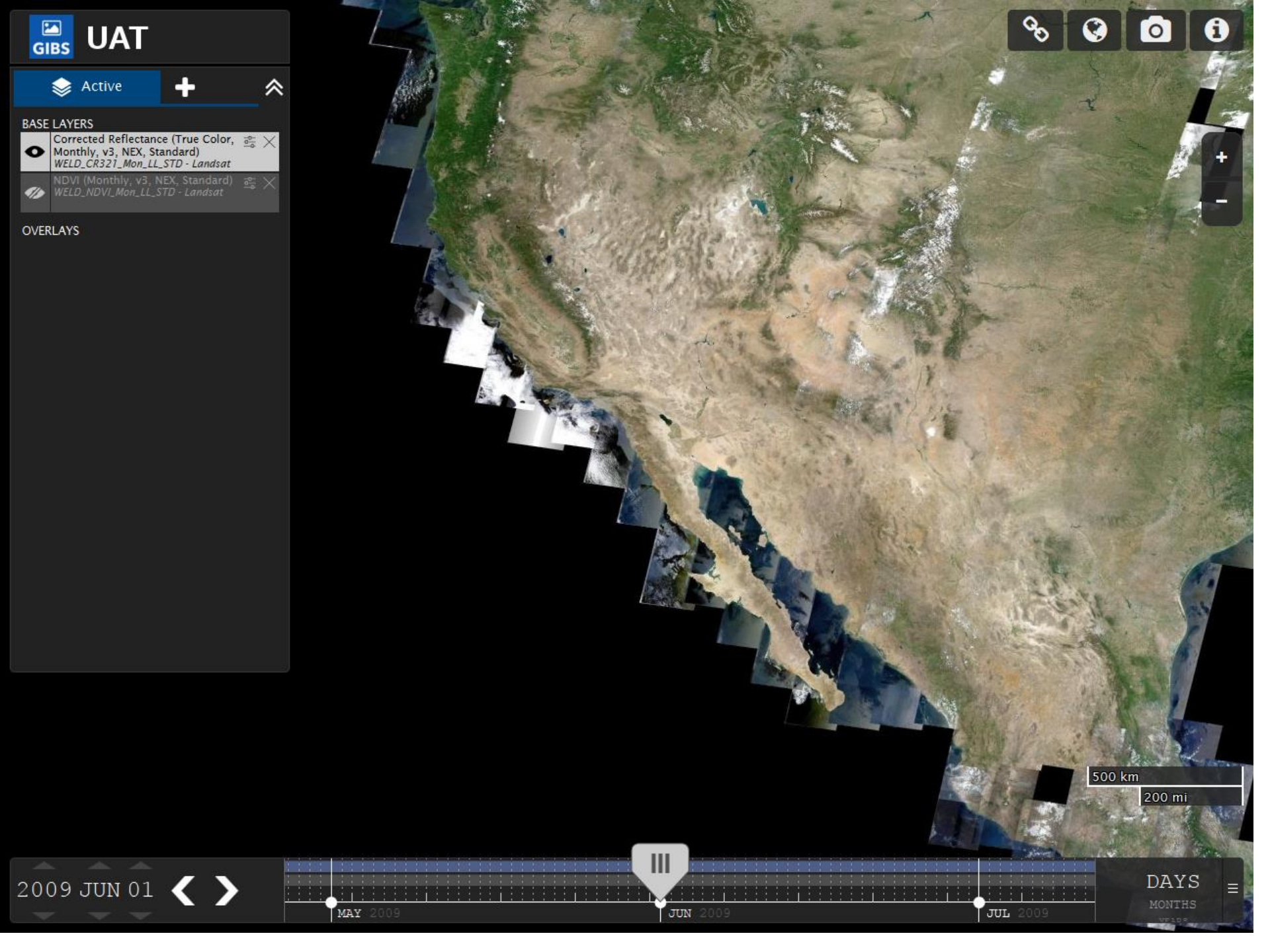
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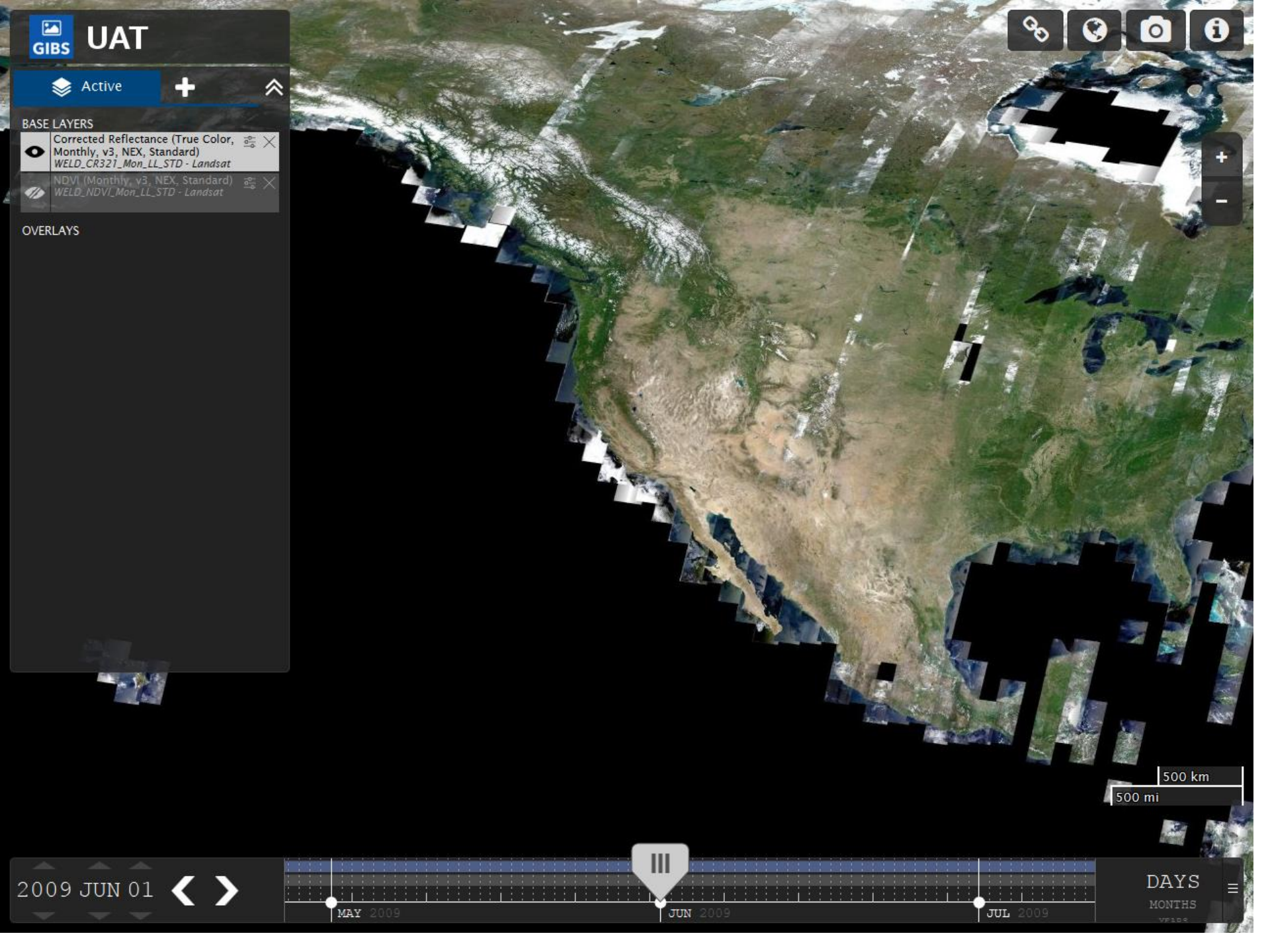
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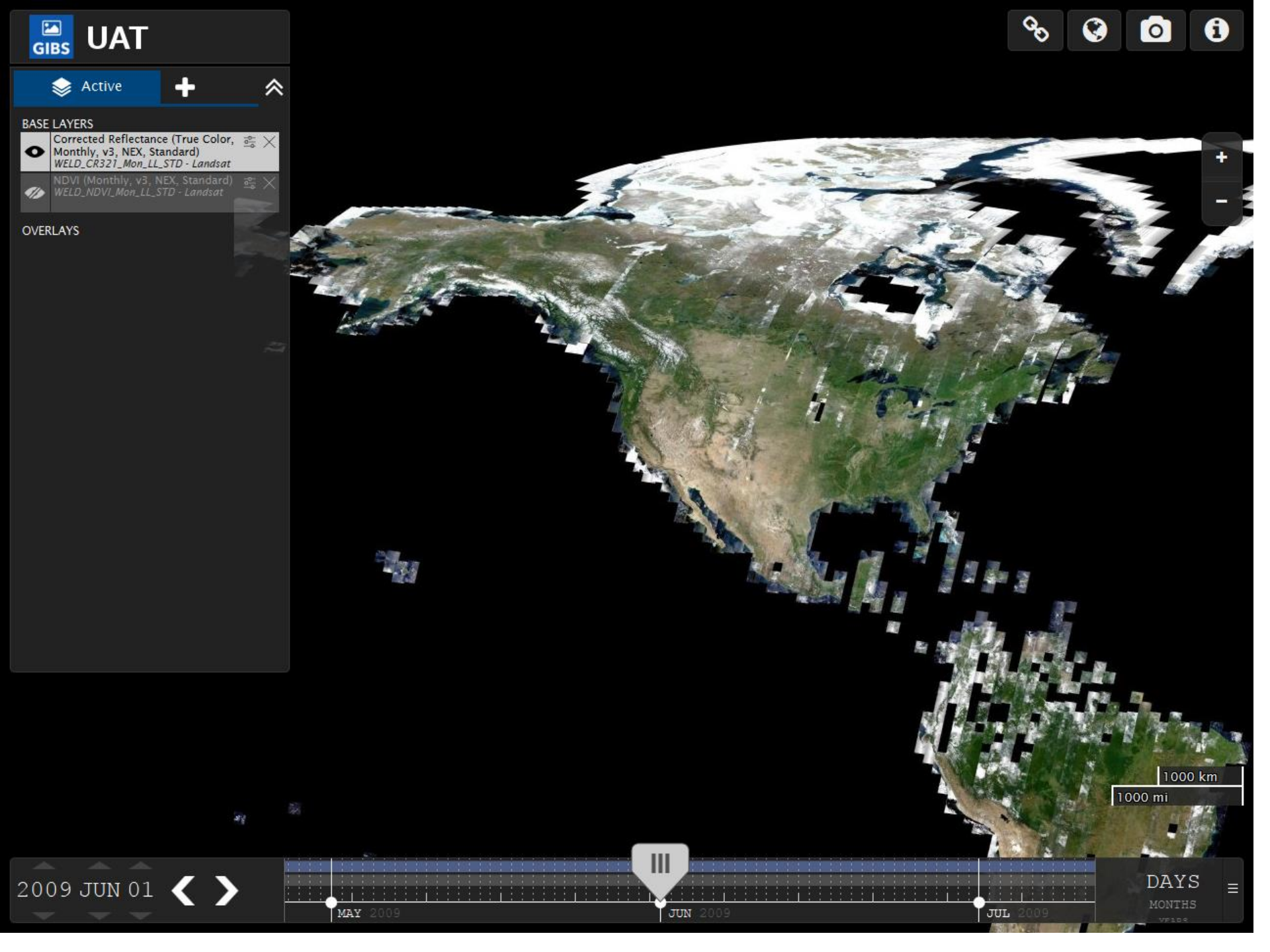
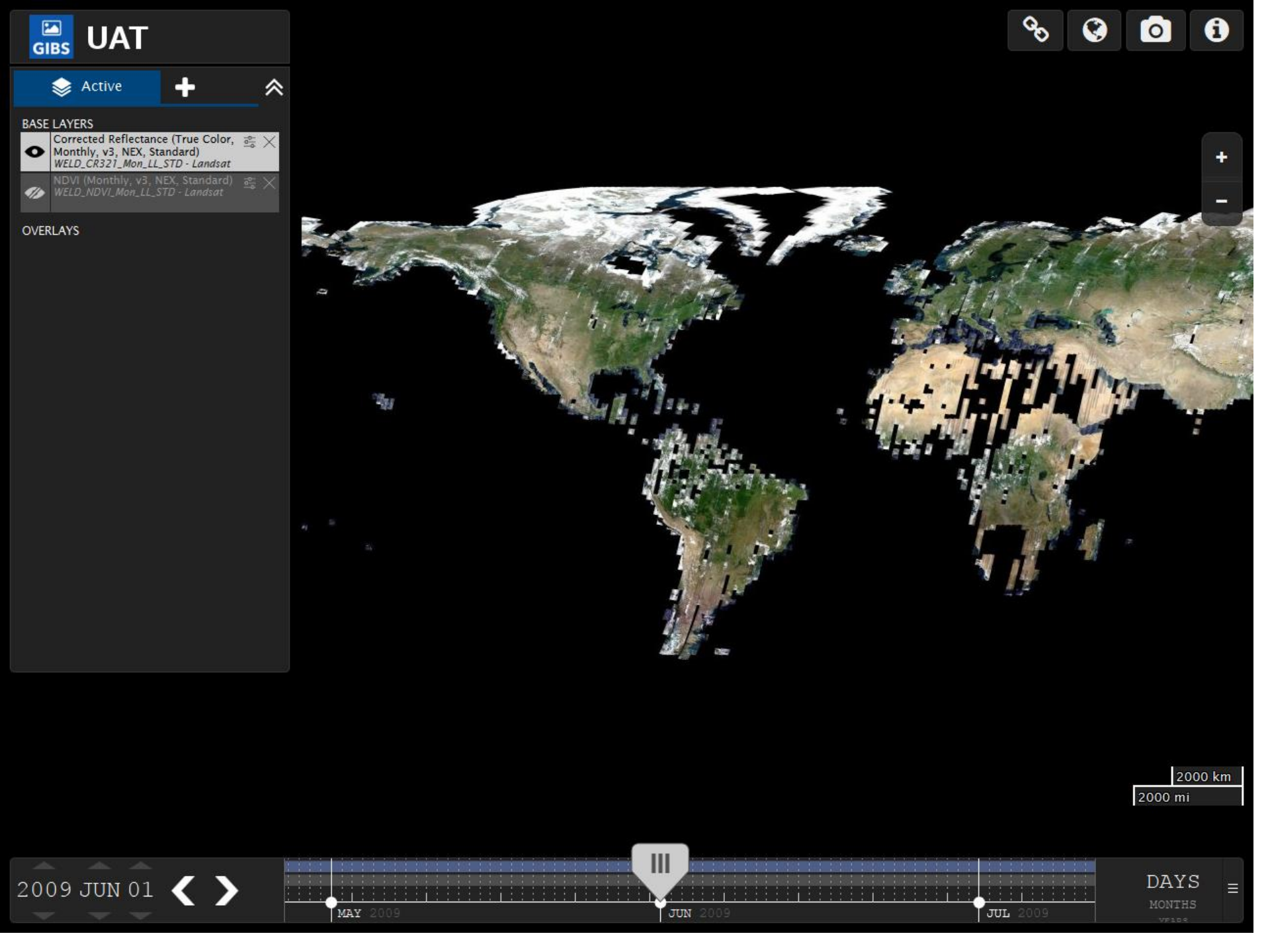
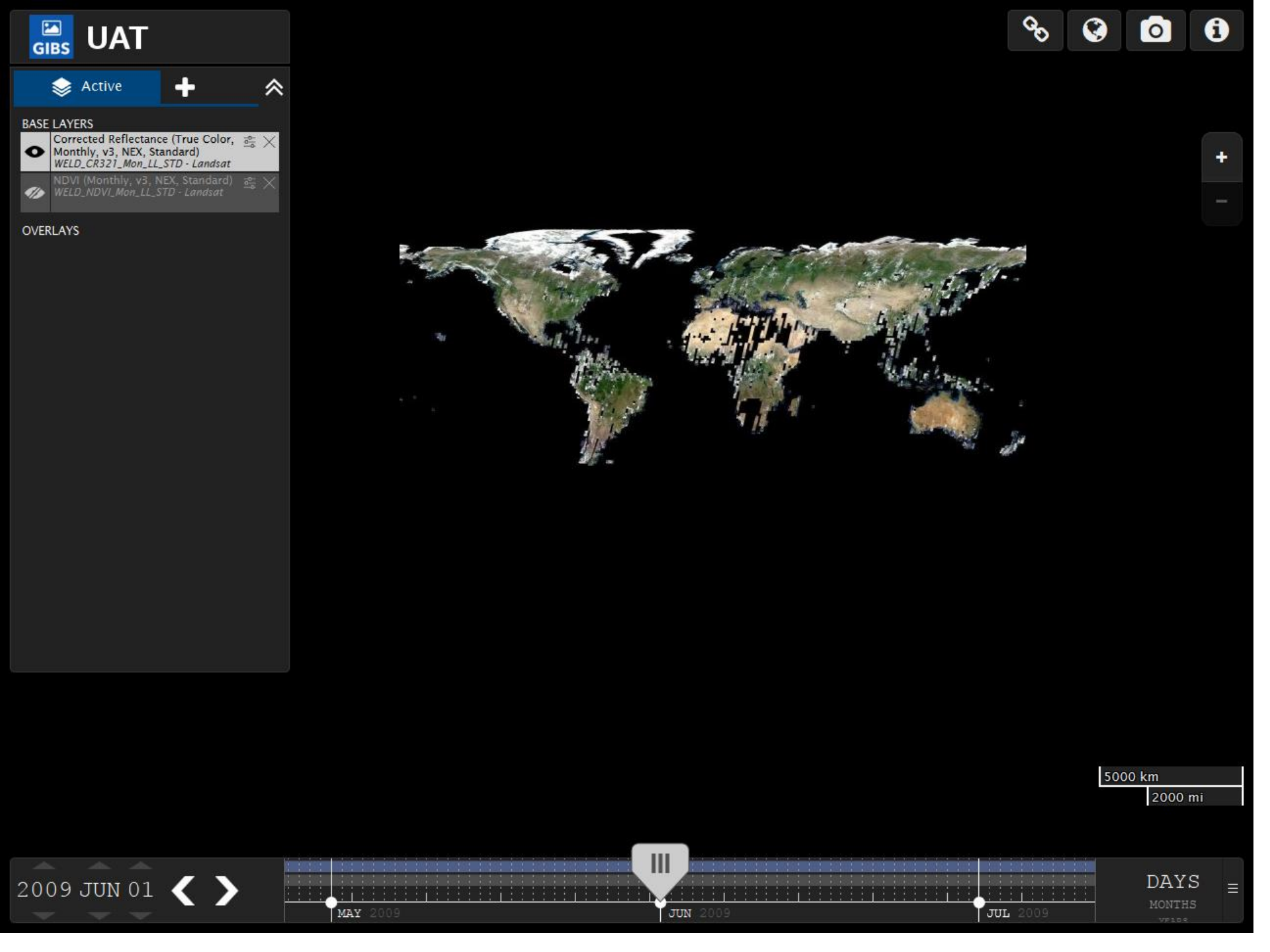
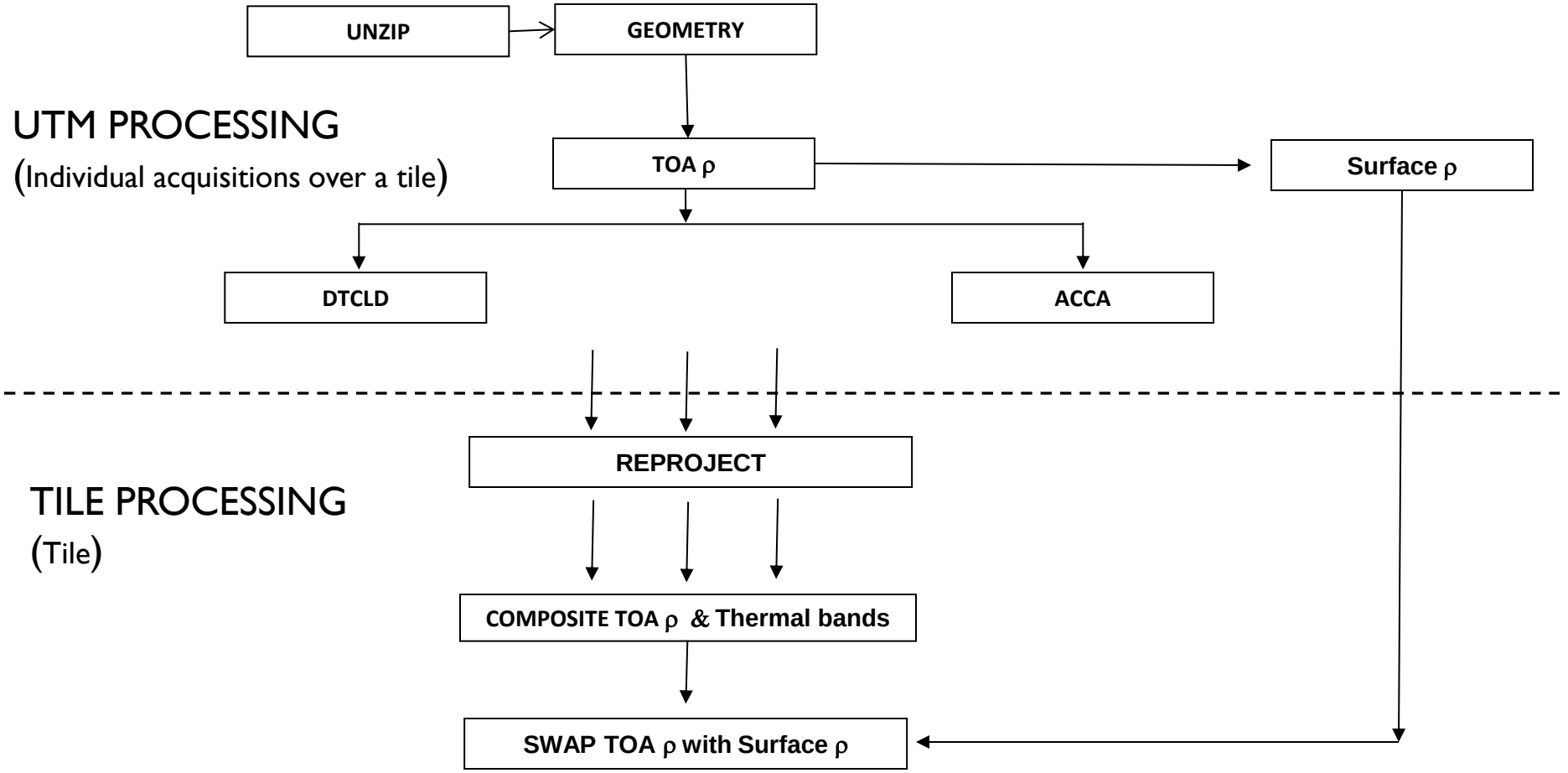
DAYS
MONTHS


GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
1000 km
1000 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS

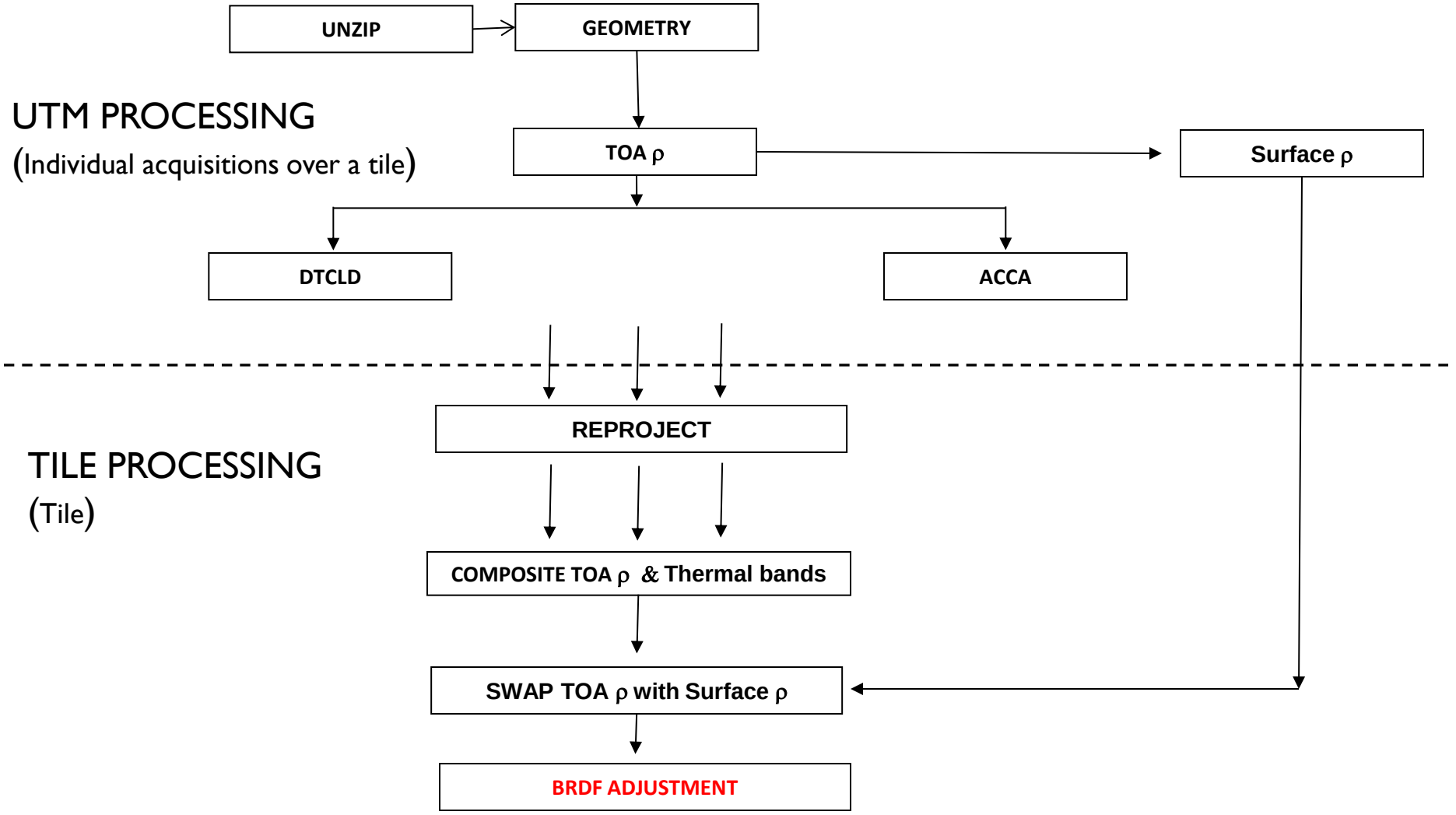

GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
2000 km
2000 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS


GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
5000 km
2000 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS

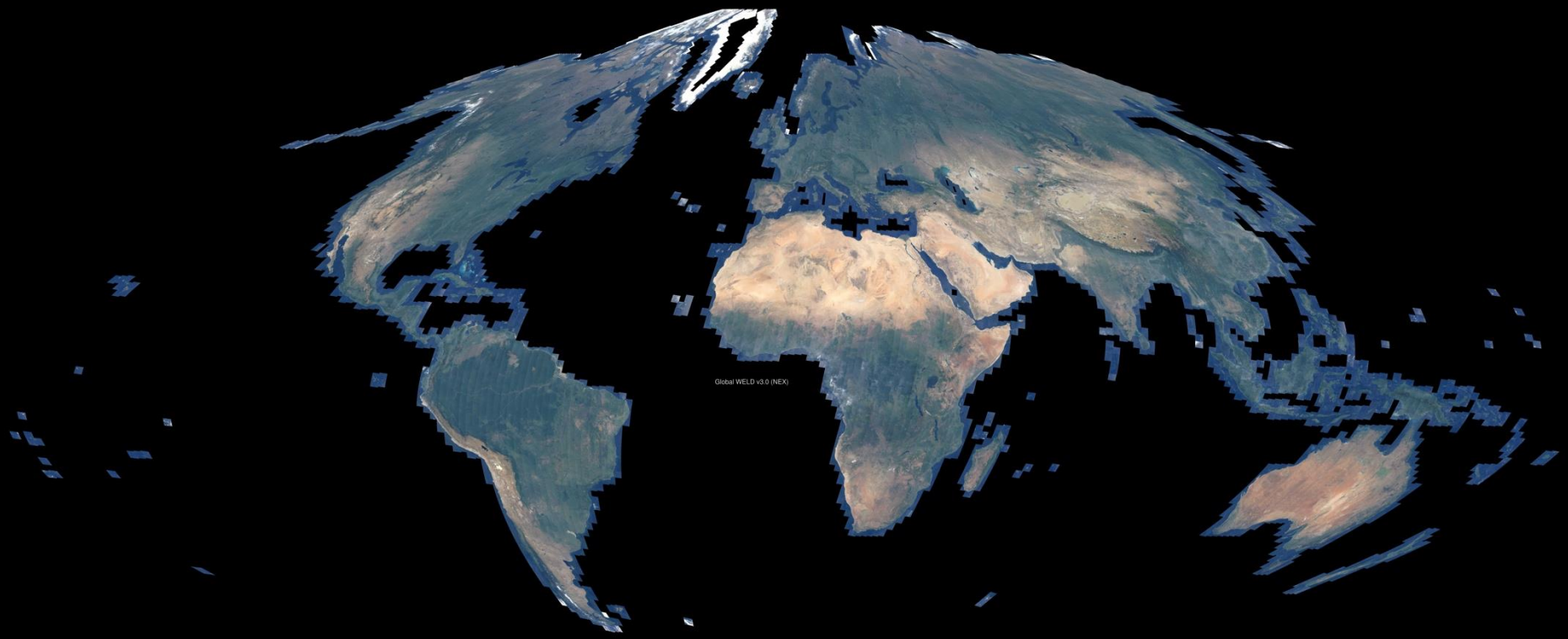
Overview of Global Version 3.0 WELD Processing Sequence



Overview of Global Version 3.0 WELD Processing Sequence



WELD Landsat 5 & 7 TOA reflectance



Global WELD NEX Version 3.0 Annual 2009 30m product
from 141,098 L1T scenes (59,183 Landsat 5 & 81,915 Landsat 7)

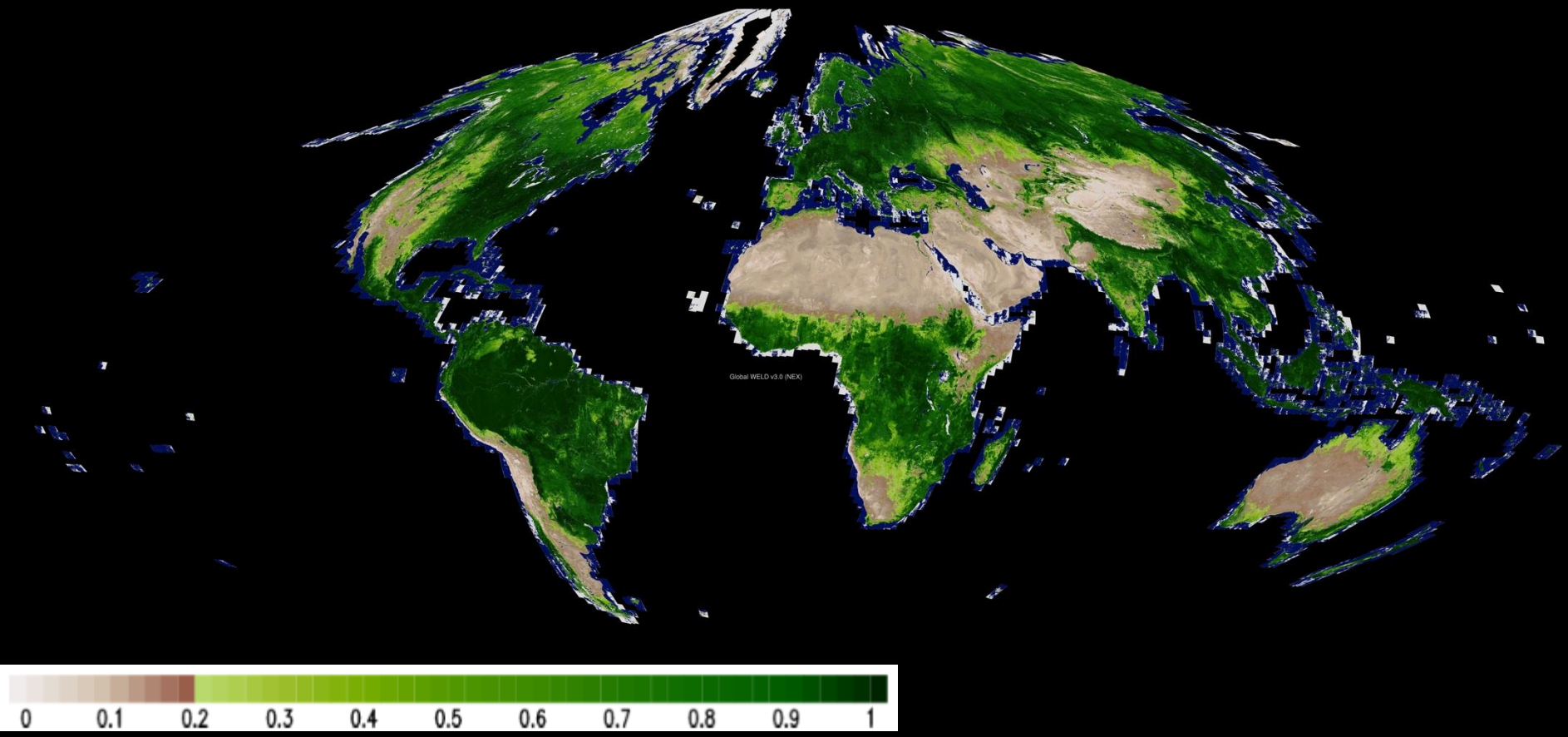
Sinusoidal Equal Area Projection

WELD Landsat 5 & 7 surface reflectance normalized BRDF adjusted reflectance composite

Global WELD NEX Version 3.0 Annual 2009 30m product
from 141,098 L1T scenes (59,183 Landsat 5 & 81,915 Landsat 7)

Sinusoidal Equal Area Projection

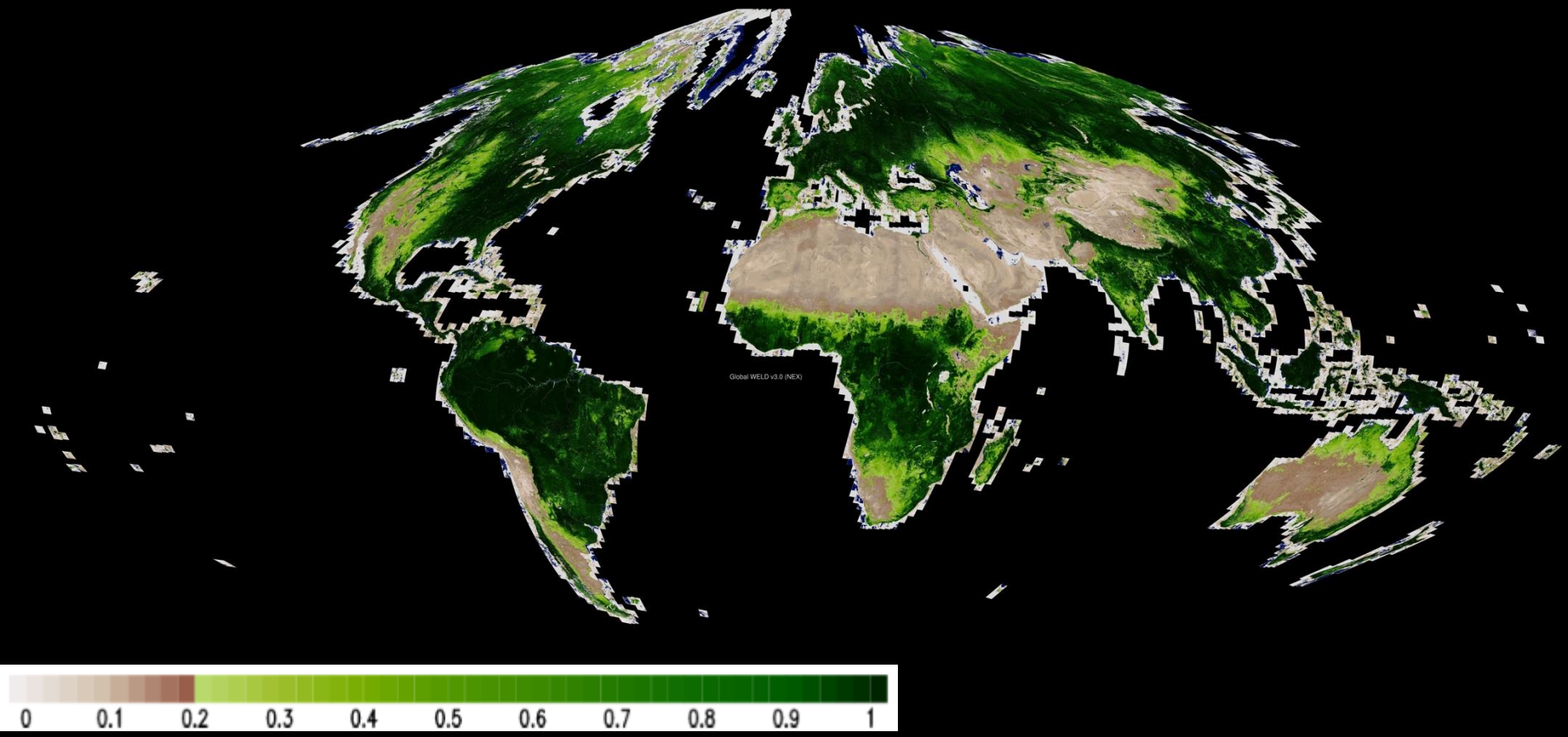
WELD Landsat 5 & 7 TOA NDVI NBAR



Global WELD NEX Version 3.0 Annual 2009 30m product
from 141,098 L1T scenes (59,183 Landsat 5 & 81,915 Landsat 7)

Sinusoidal Equal Area Projection

WELD Landsat 5 & 7 surface NDVI NBAR

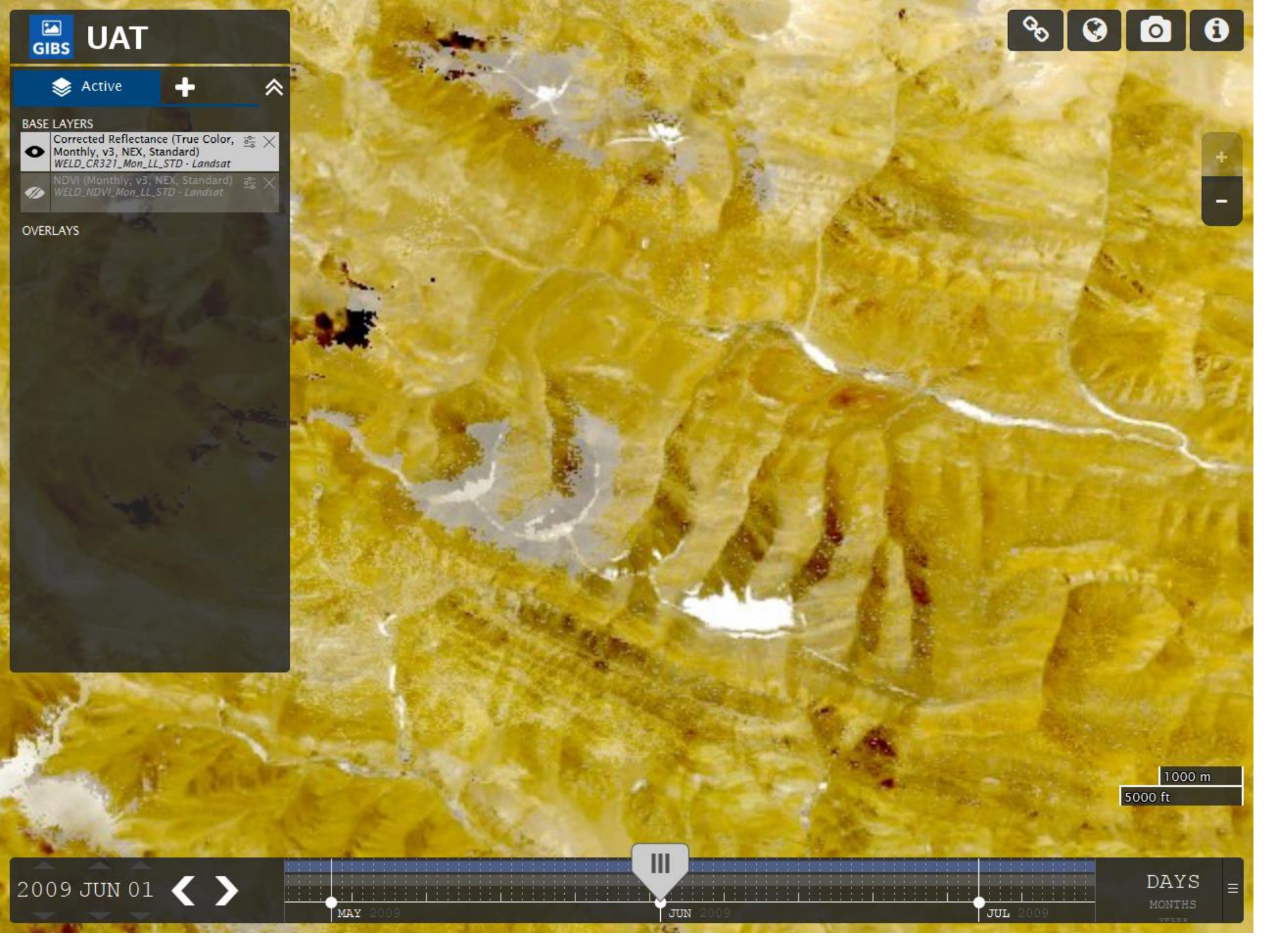


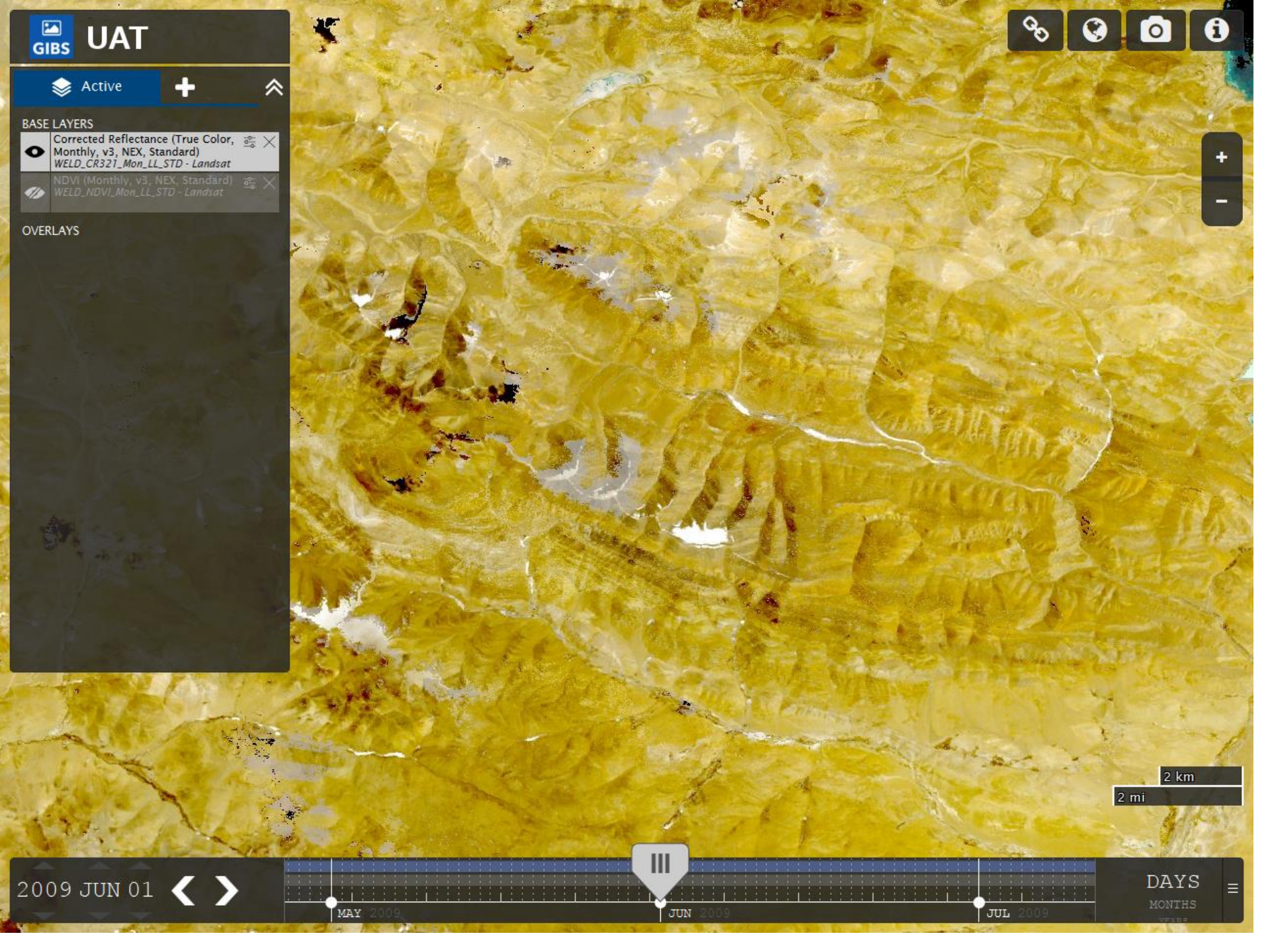
Global WELD NEX Version 3.0 Annual 2009 30m product
from 141,098 L1T scenes (59,183 Landsat 5 & 81,915 Landsat 7)

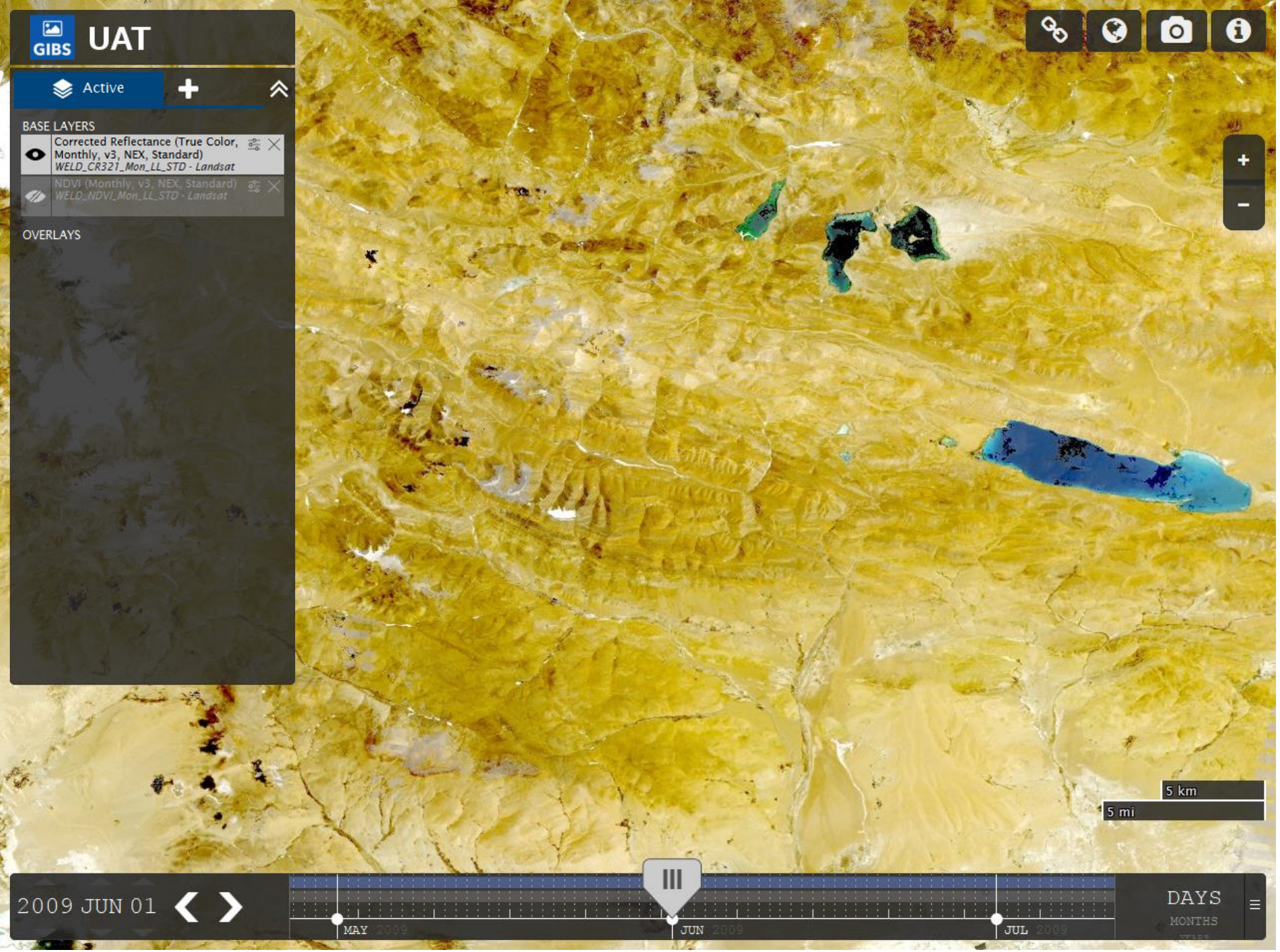
Sinusoidal Equal Area Projection

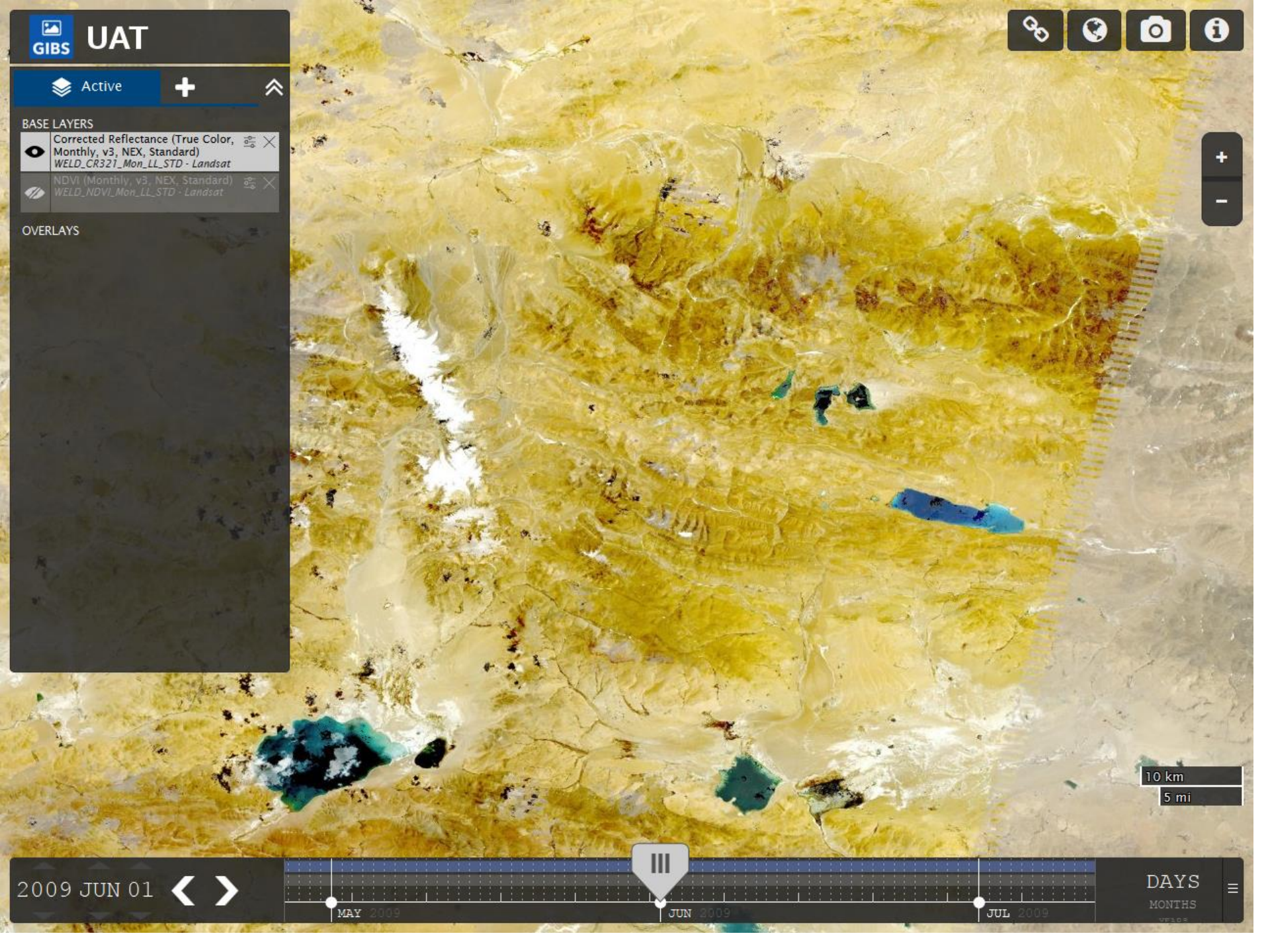

GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
Global WELD
June 2009
Surface NBAR
20 km
10 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS


GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
Global WELD
June 2009
Surface NDVI
20 km
10 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS


GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
1000 m
5000 ft
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS


GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
2 km
2 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS

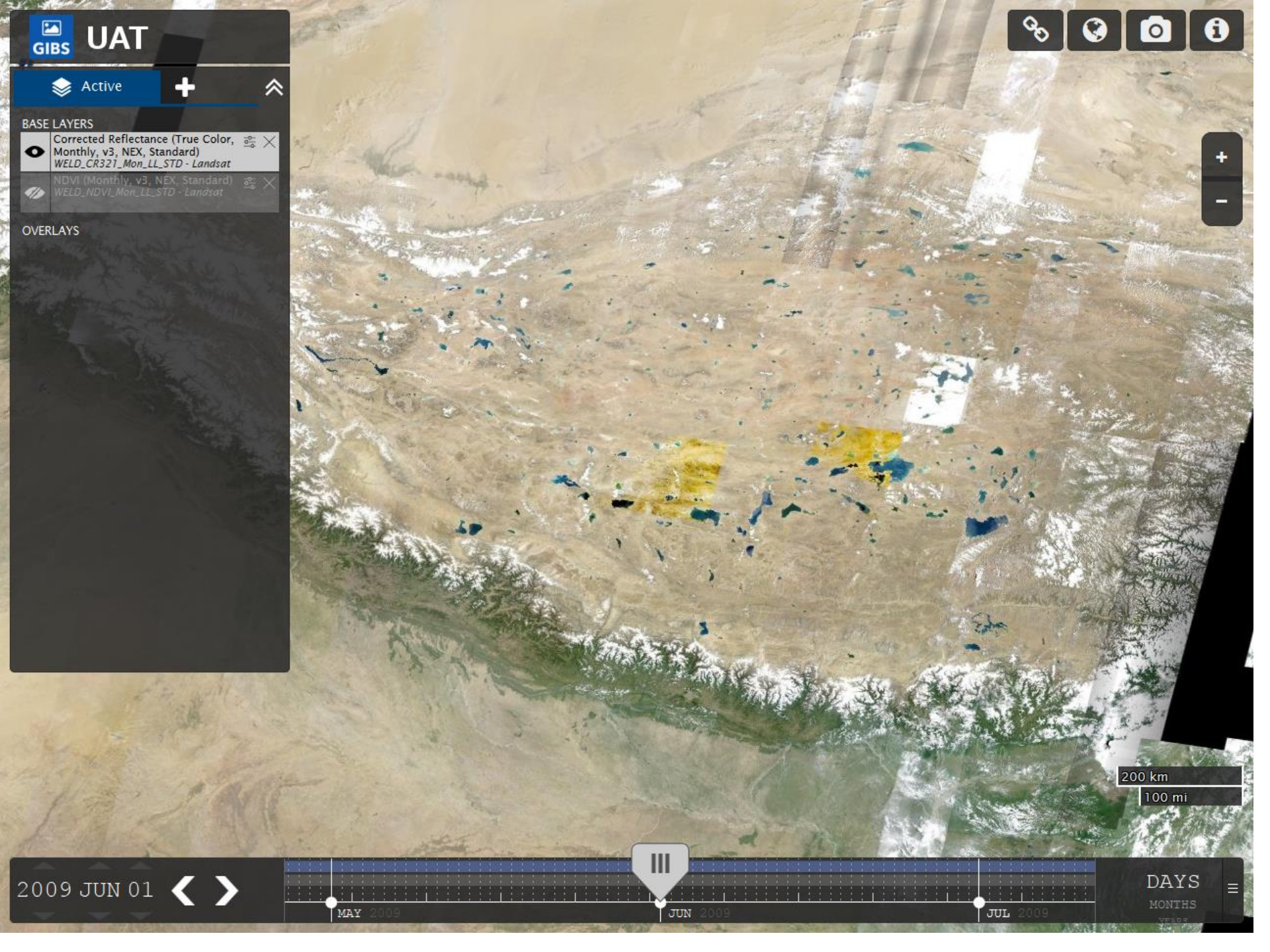

GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
5 km
5 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS

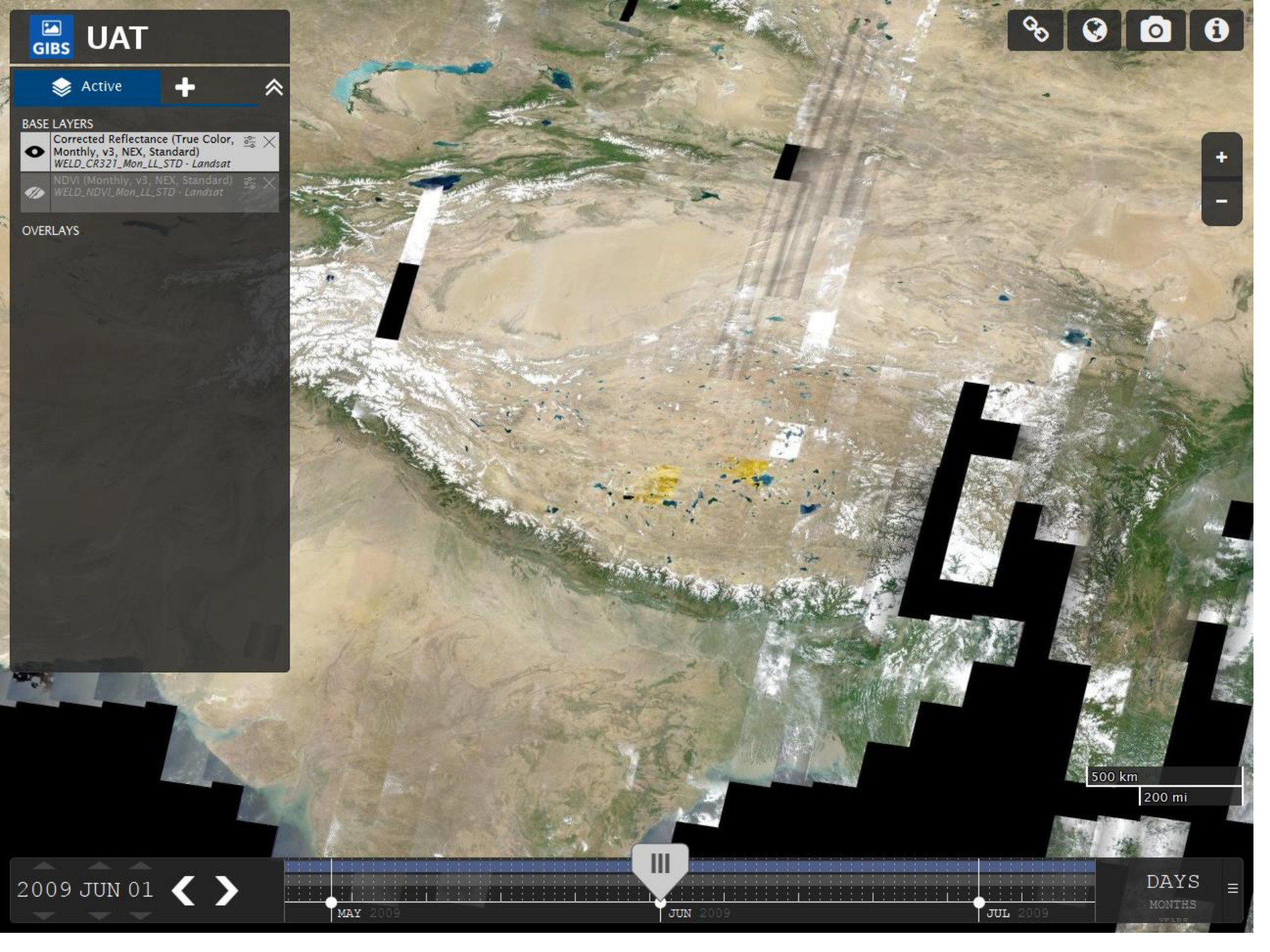

GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
10 km
5 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS


GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
20 km
10 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS

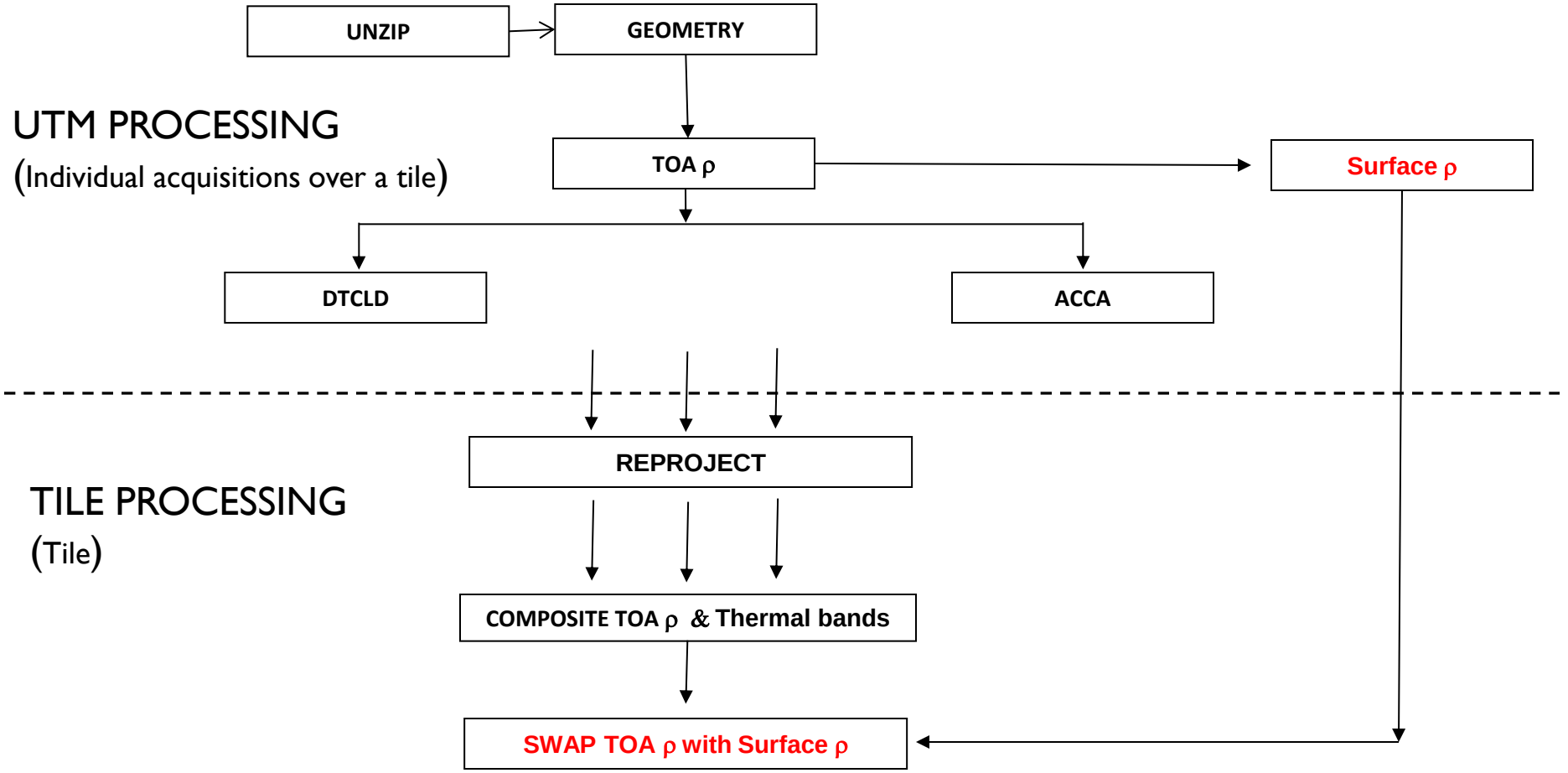

GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
50 km
20 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS


GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
100 km
50 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS

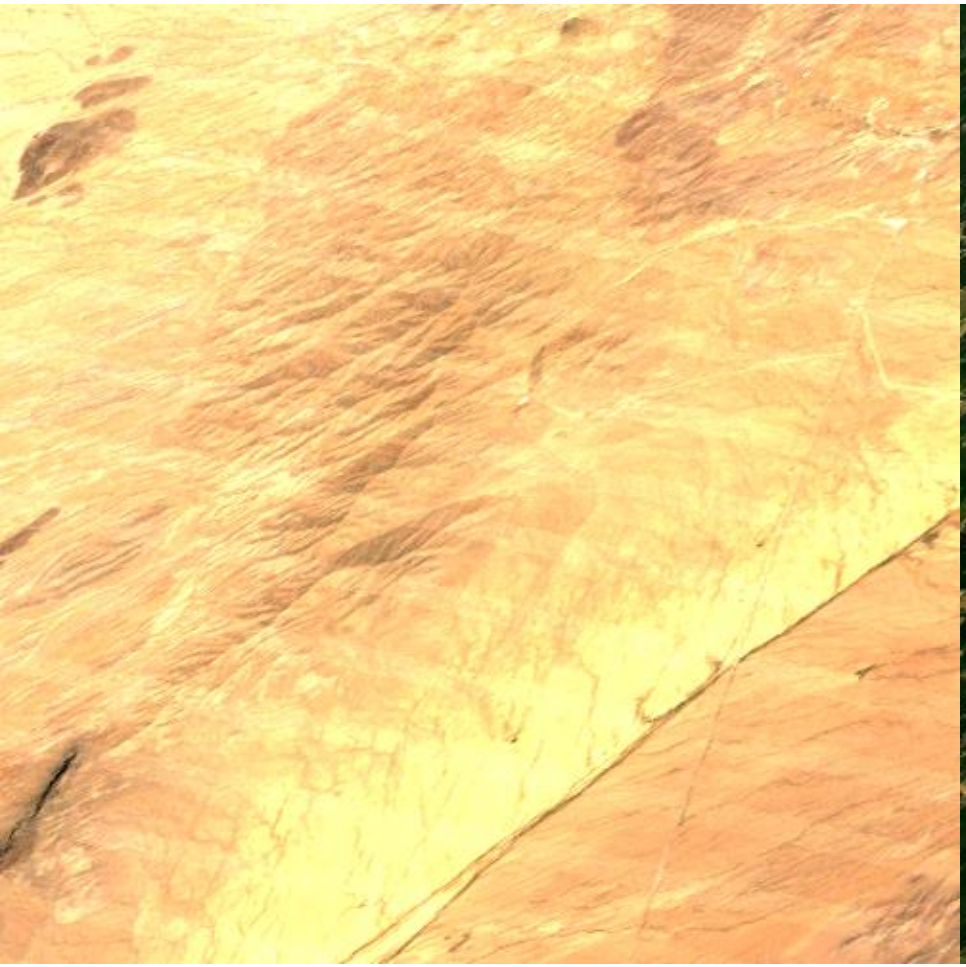

GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
200 km
100 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS


GIBS
UAT
Active
BASE LAYERS
Corrected Reflectance (True Color, Monthly, v3, NEX, Standard)
WELD_CR321_Mon_LL_STD - Landsat
NDVI (Monthly, v3, NEX, Standard)
WELD_NDVI_Mon_LL_STD - Landsat
OVERLAYS
500 km
200 mi
2009 JUN 01
MAY 2009
JUN 2009
JUL 2009
DAYS
MONTHS

Overview of Global Version 3.0 WELD Processing Sequence



WELD Landsat 5 & 7 surface reflectance one week composite



Arizona

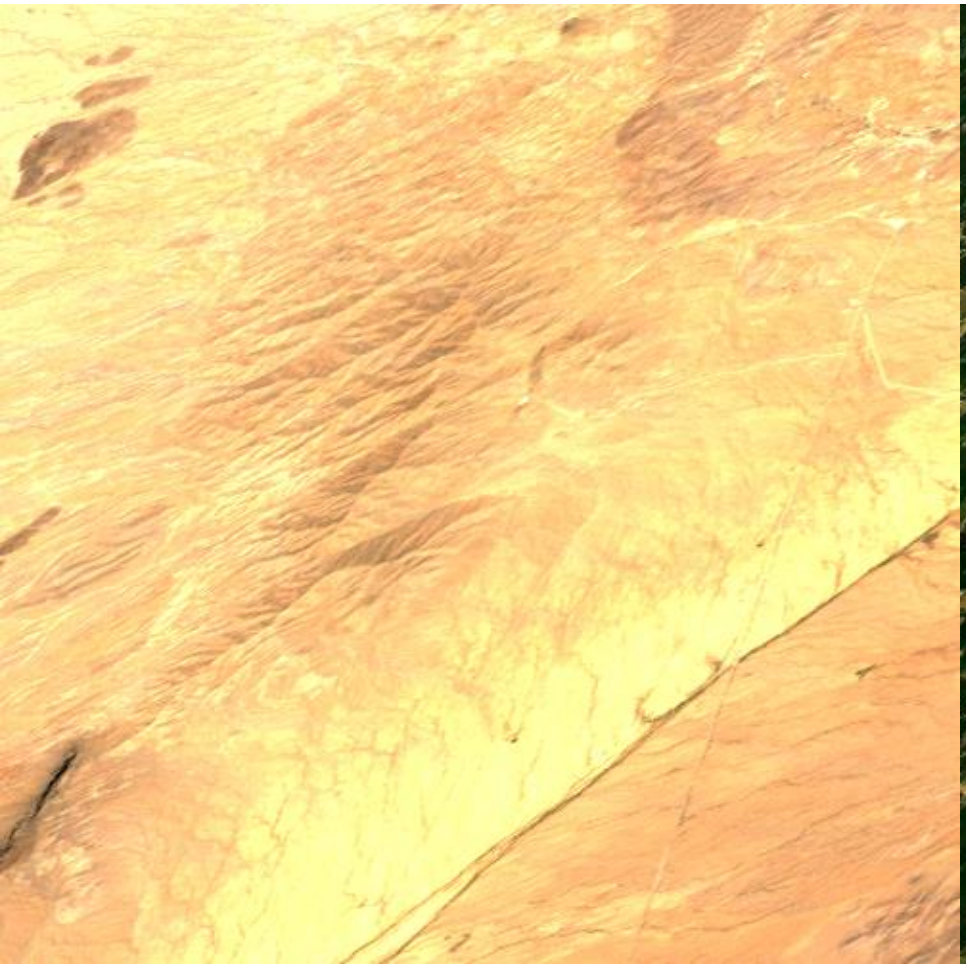
Mississippi

500 x 500 30m pixels

WELD Landsat 5 & 7 surface reflectance one week composite

normalized BRDF adjusted reflectance (NBAR)

0° view zenith & local overpass solar zenith



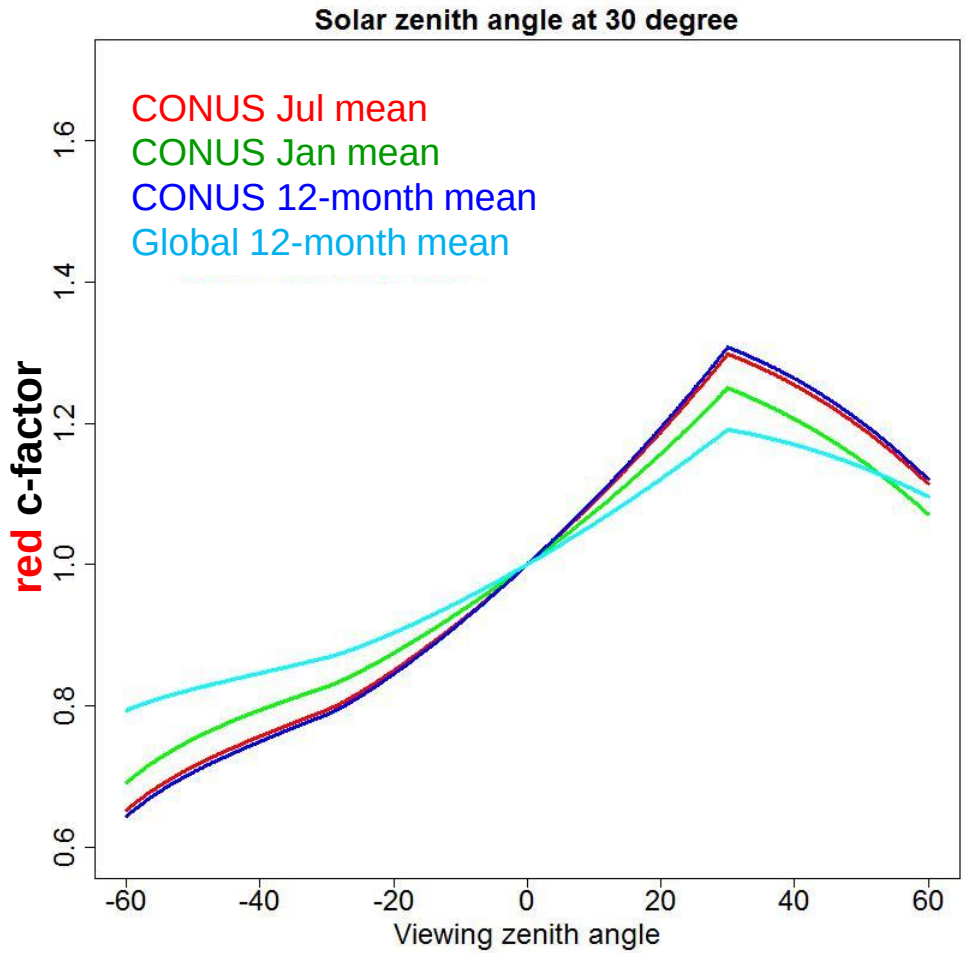
Arizona

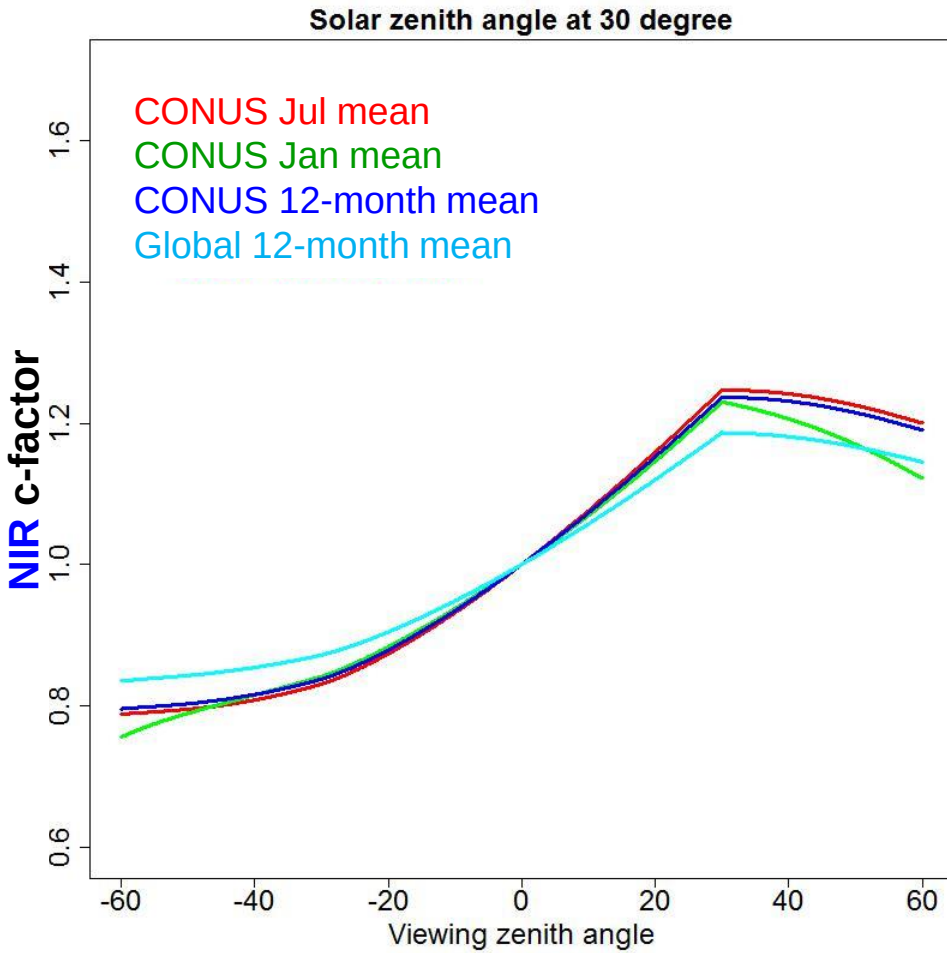
500 x 500 30m pixels

Mississippi

c-factors over MODIS 110° FOV

derived using mean MDC43 spectral BRDF model parameters

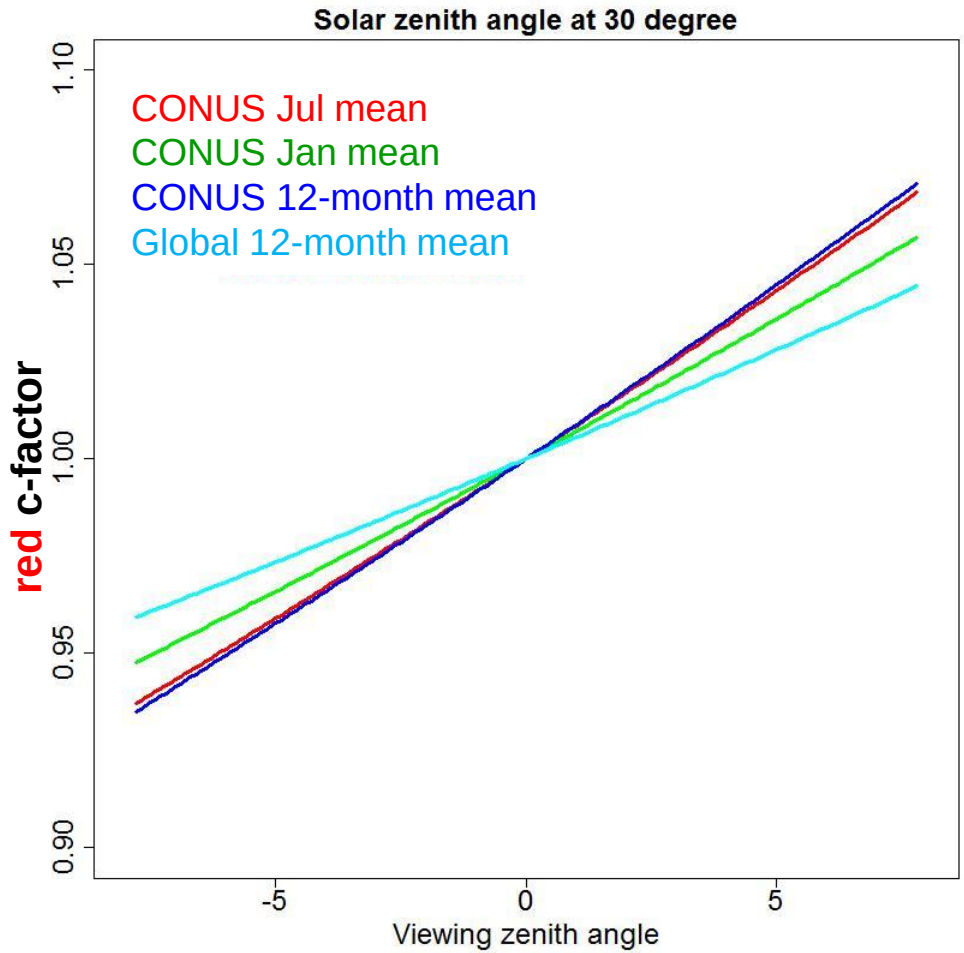


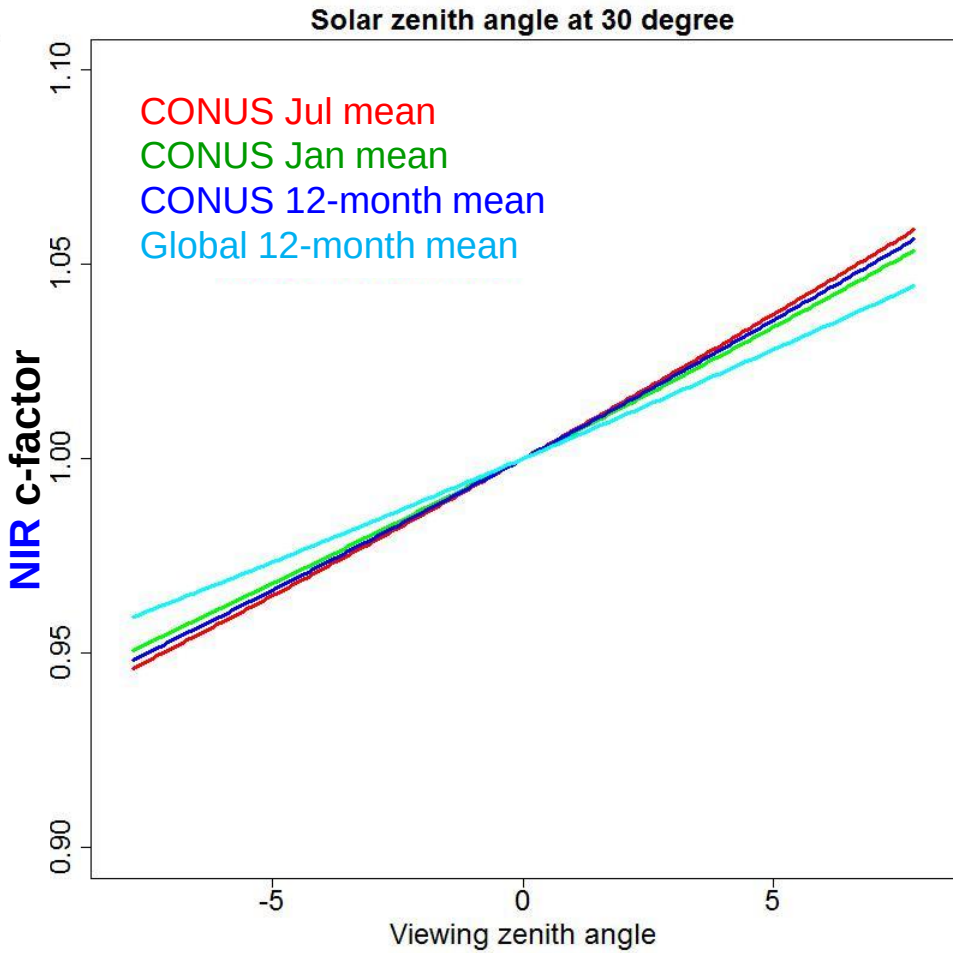


Roy et al. A general method to normalize Landsat reflectance data to nadir BRDF adjusted reflectance, *Remote Sensing of Environment*.

c-factors over Landsat 15° FOV

derived using mean MDC43 spectral BRDF model parameters



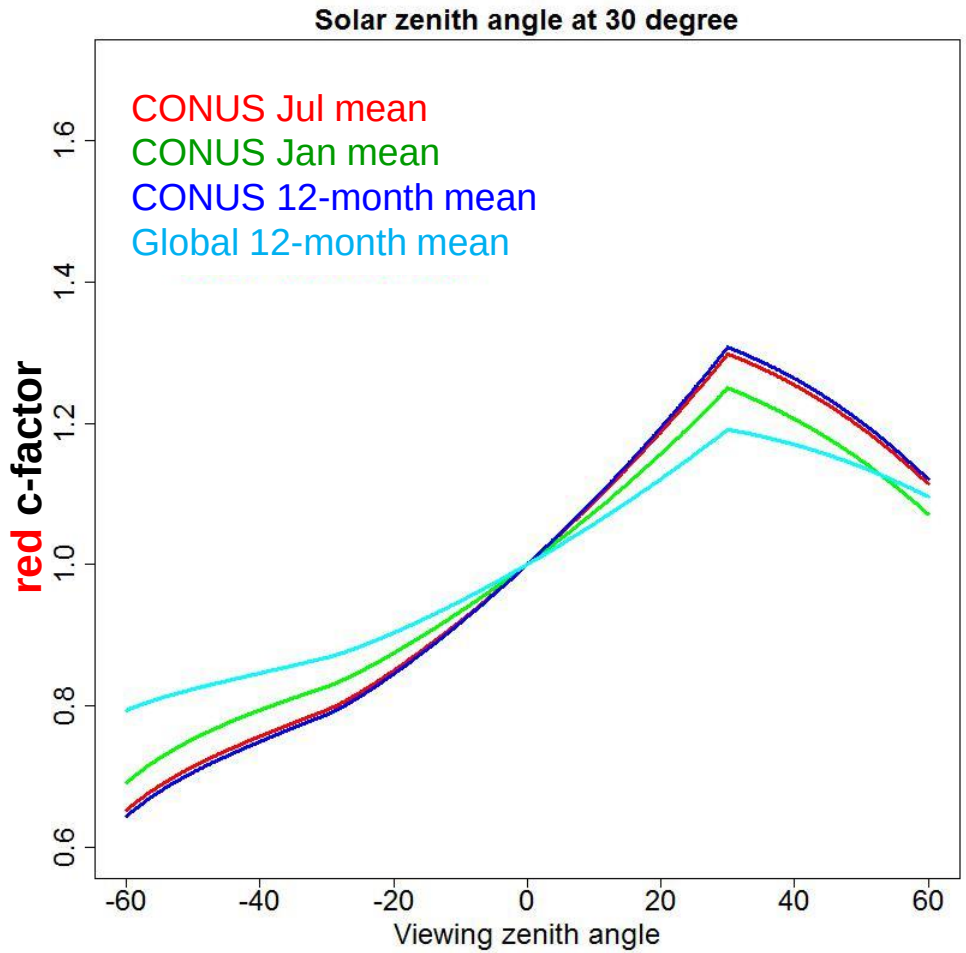


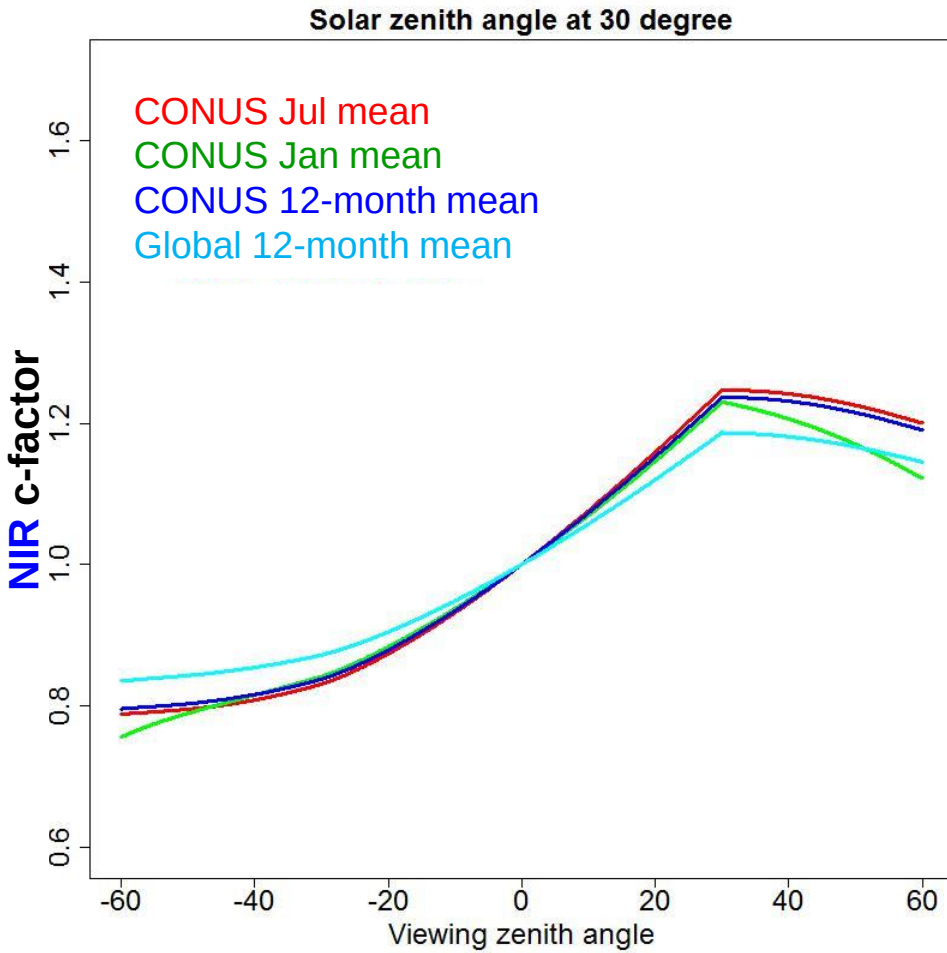
Roy et al. A general method to normalize Landsat reflectance data to nadir BRDF adjusted reflectance, *Remote Sensing of Environment*.

c-factors over MODIS 110° FOV

derived using mean MDC43 spectral BRDF model parameters

(similar over Sentinel-2 20.6° FOV)



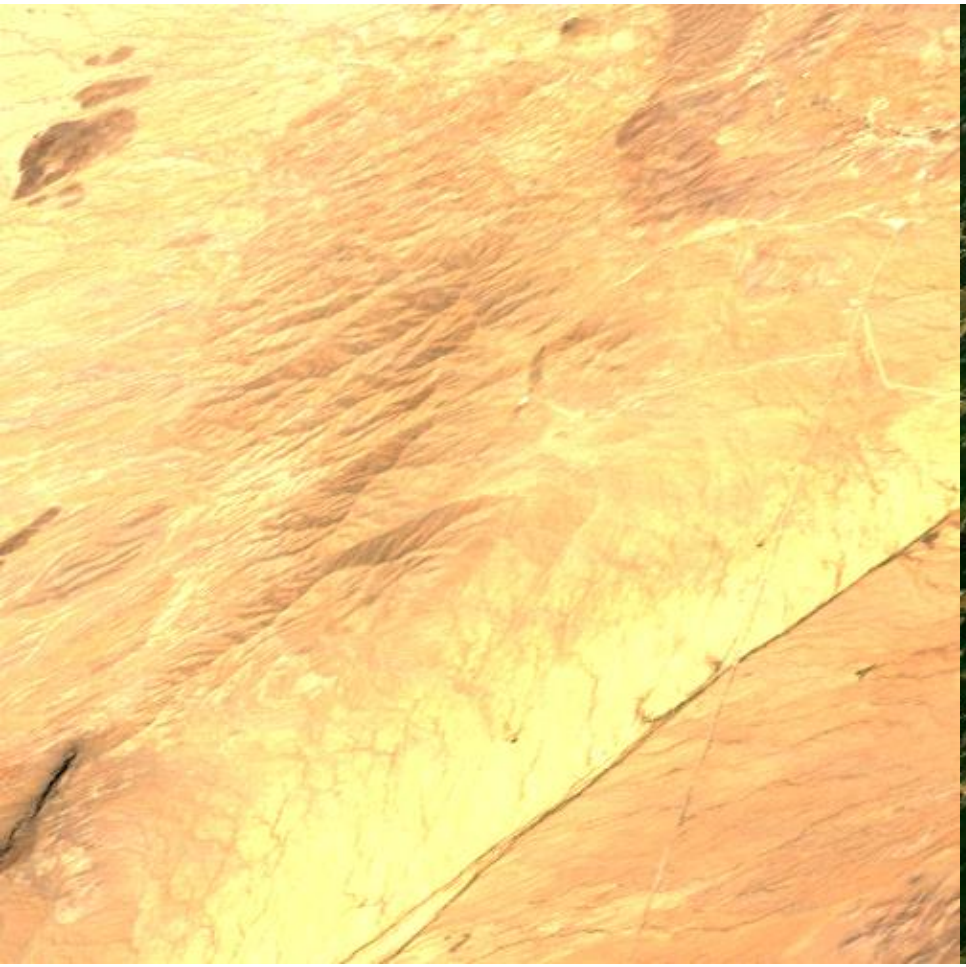


Roy et al. A general method to normalize Landsat reflectance data to nadir BRDF adjusted reflectance, *Remote Sensing of Environment*.

WELD Landsat 5 & 7 surface reflectance one week composite

normalized BRDF adjusted reflectance (NBAR)

0° view zenith & local Landsat overpass solar zenith

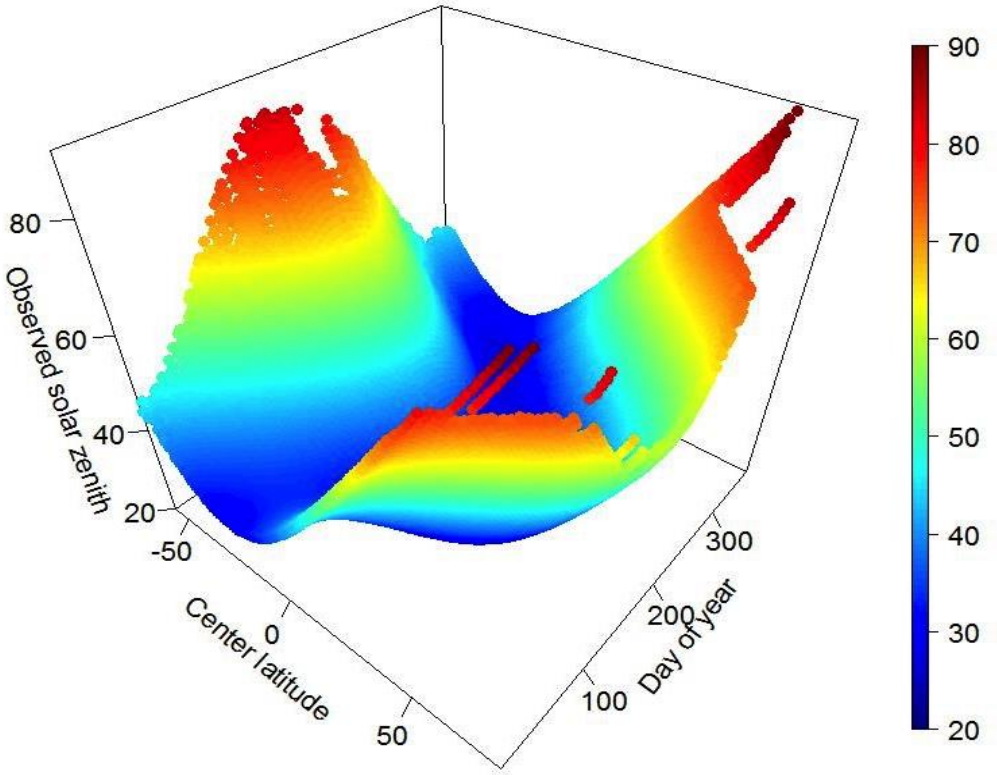


Arizona

500 x 500 30m pixels

Mississippi

12 months of non-Antarctic (147,358 Landsat 5 and 7 acquisitions) Landsat solar zenith (θ_s) plotted as a function of scene center latitude and day of year



$22.14^o <= \theta_s <= 89.71^o$

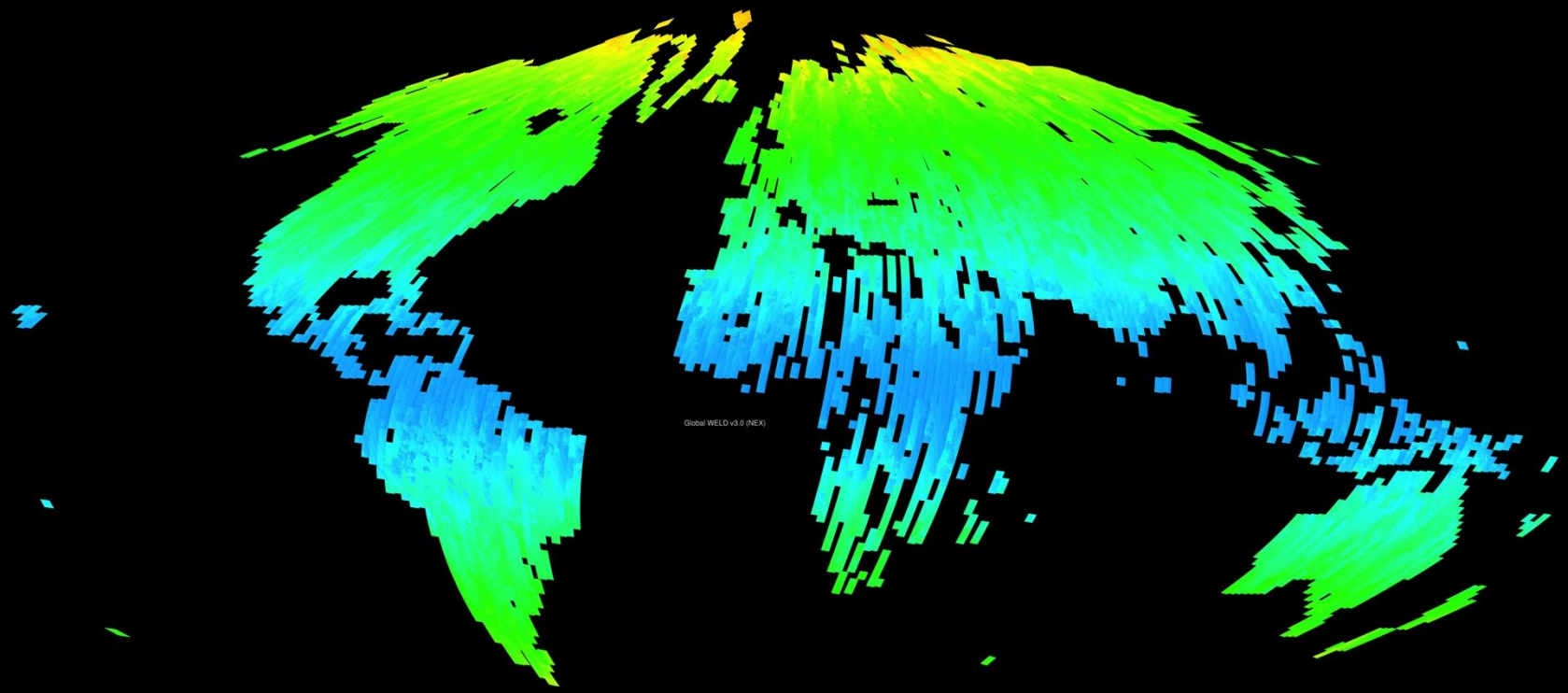
θ_s mean = 43.23^o

5th degree degree polynomial used to model the local overpass time as a function of latitude for both Landsat sensors:

$$\hat{t}_{local} = 1.36292\times10^{-9}\alpha^5 - 3.15403\times10^{-8}\alpha^4 - 3.15819614\times10^{-6}\alpha^3 + 0.0000652685643\alpha^2 + 0.0120604786763\alpha + 10.06$$

Zhang, H.K., Roy, D.P., & Kovalskyy, V. (2016). Optimal solar geometry definition for global long-term Landsat time-series bidirectional reflectance normalization. *IEEE TGRS, In press.*

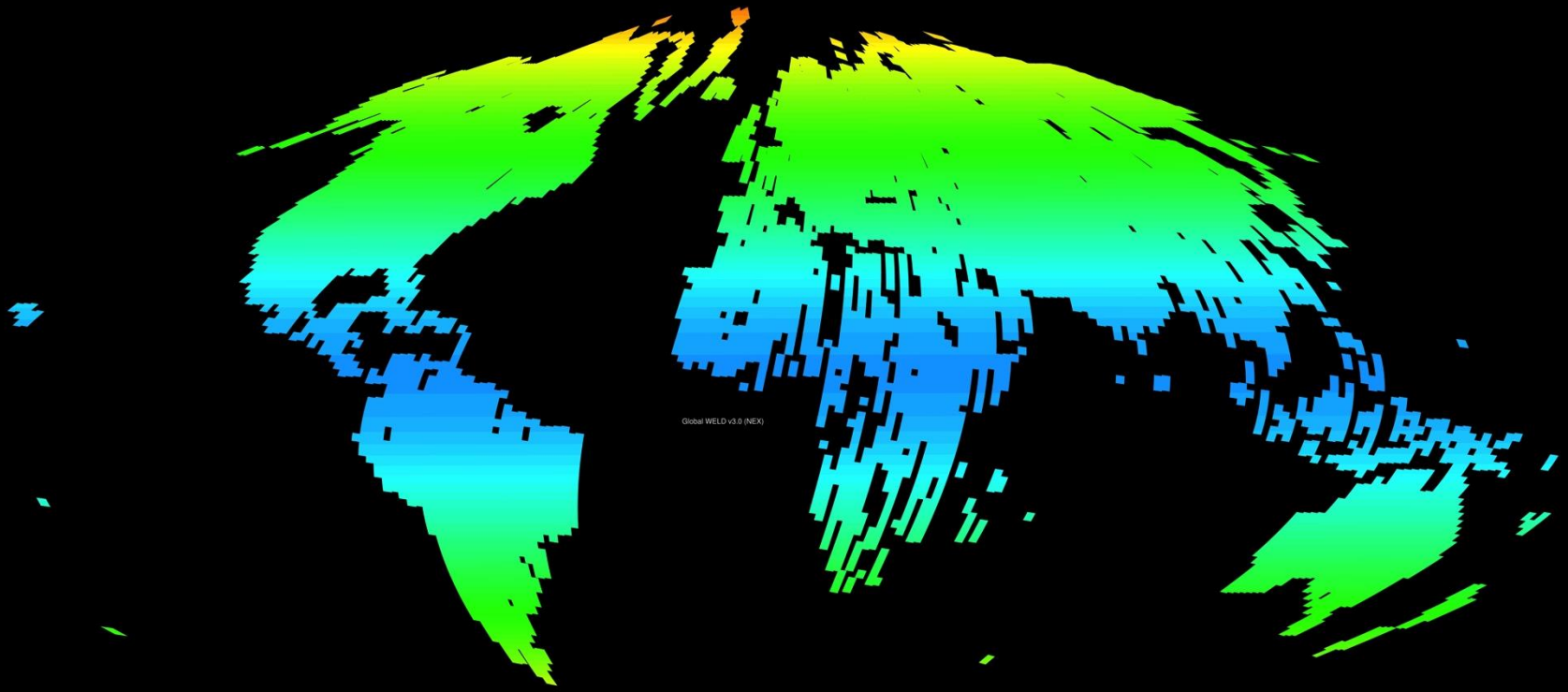
WELD Landsat 5 & 7 observed Solar Zenith



Global WELD NEX Version 3.0 September 2009 30m product
from 15,058 L1T scenes (7,328 Landsat 5 & 7,730 Landsat 7)

Sinusoidal Equal Area Projection

WELD Landsat 5 & 7 modelled Solar Zenith used to derived the WELD NBAR

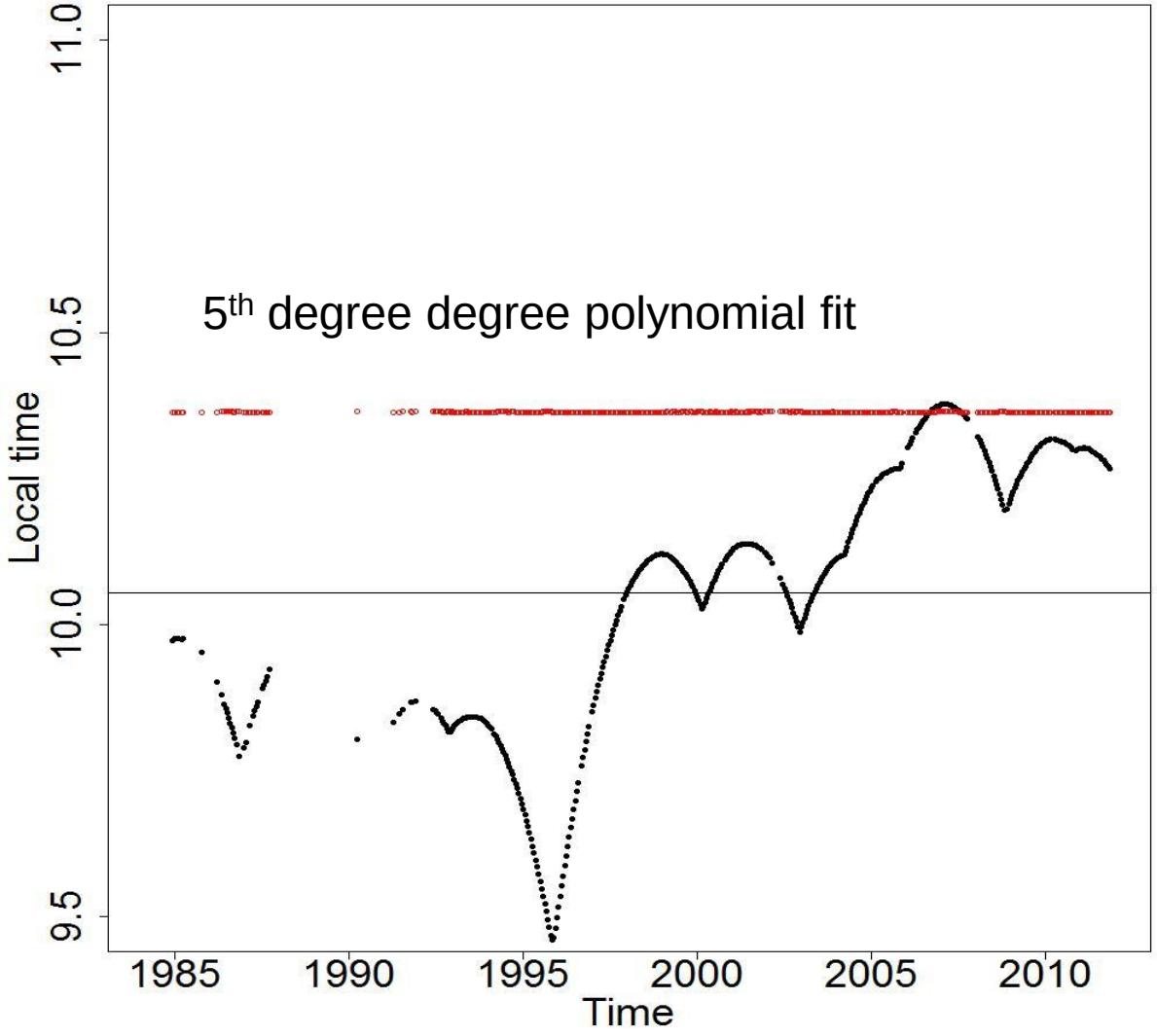


Global WELD NEX Version 3.0 September 2009 30m product
from 15,058 L1T scenes (7,328 Landsat 5 & 7,730 Landsat 7)

Sinusoidal Equal Area Projection

Long term Landsat NBAR generation implications …

Landsat 5 local time derived from Landsat metadata



Landsat
path/row 27/42
(somewhere in Texas)

Local time difference
0.9714 hours over 27
years of Landsat 5 !

WELD Landsat 5 & 7 surface reflectance normalized BRDF adjusted reflectance composite

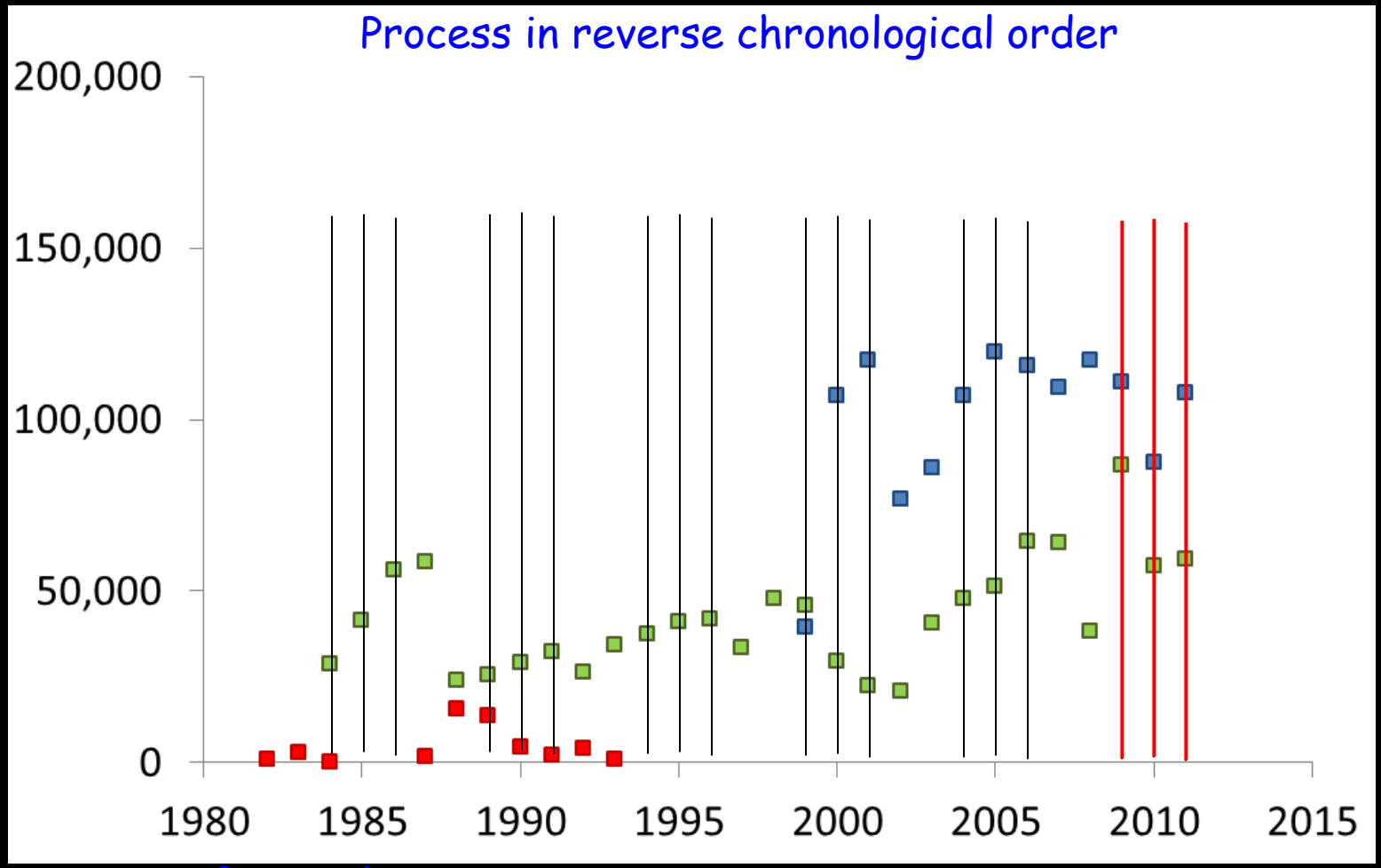
Global WELD NEX Version 3.0 Annual 2009 30m product from 141,098 L1T scenes (59,183 Landsat 5 & 81,915 Landsat 7)

Sinusoidal Equal Area Projection

Global WELD Version 3.0 (NBAR surface reflectance) available February 2016

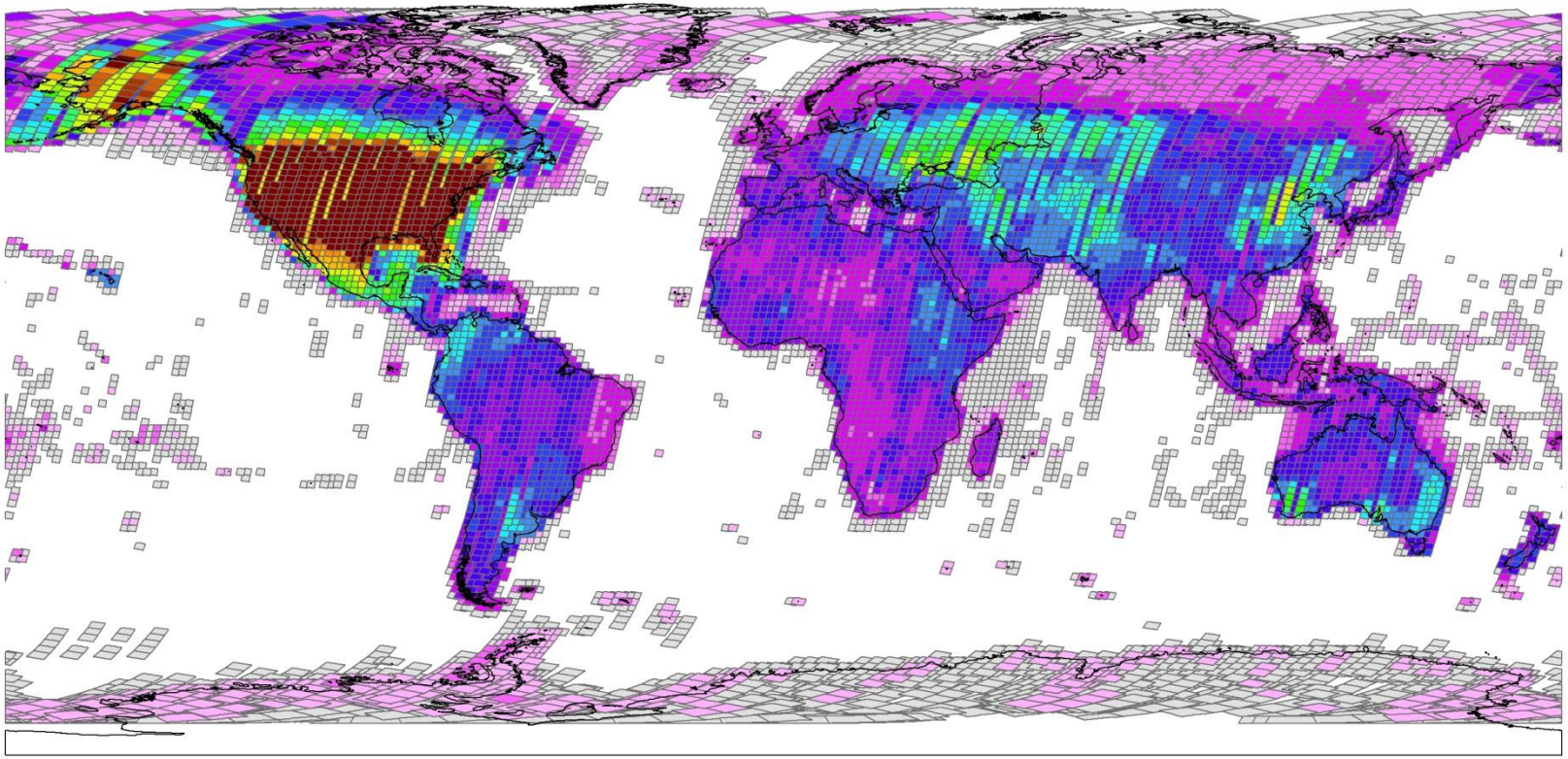
Planned Global WELD V3.0 Production

Monthly + Annual 30m products, fusion of contemporaneous Landsat 4,5,7



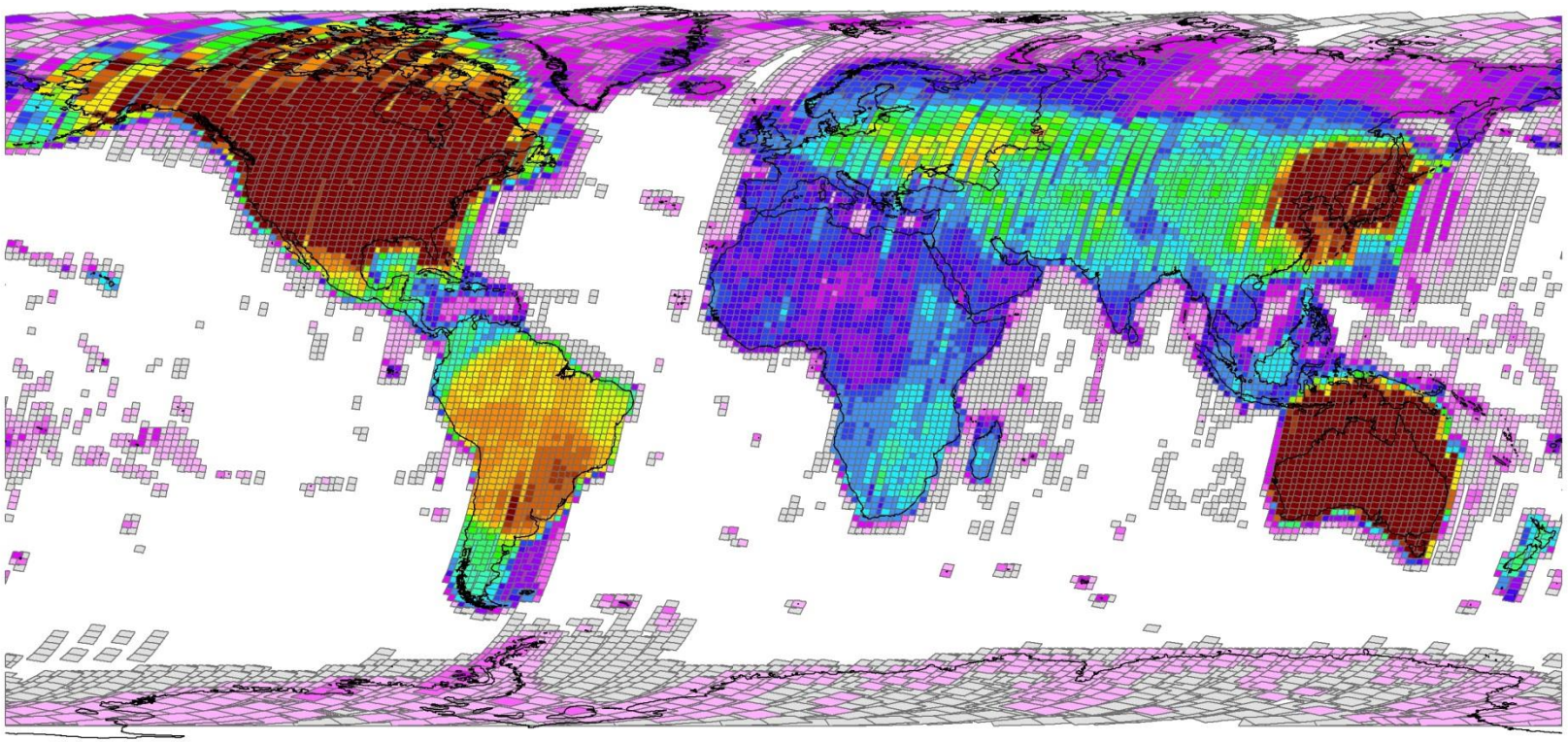
Landsat repatriation from other space agencies will provide more Landsat data in earlier epochs

USGS archive prior to LGAC



Wulder, et al. 2016. RSE.

USGS archive up to Jan 1, 2015



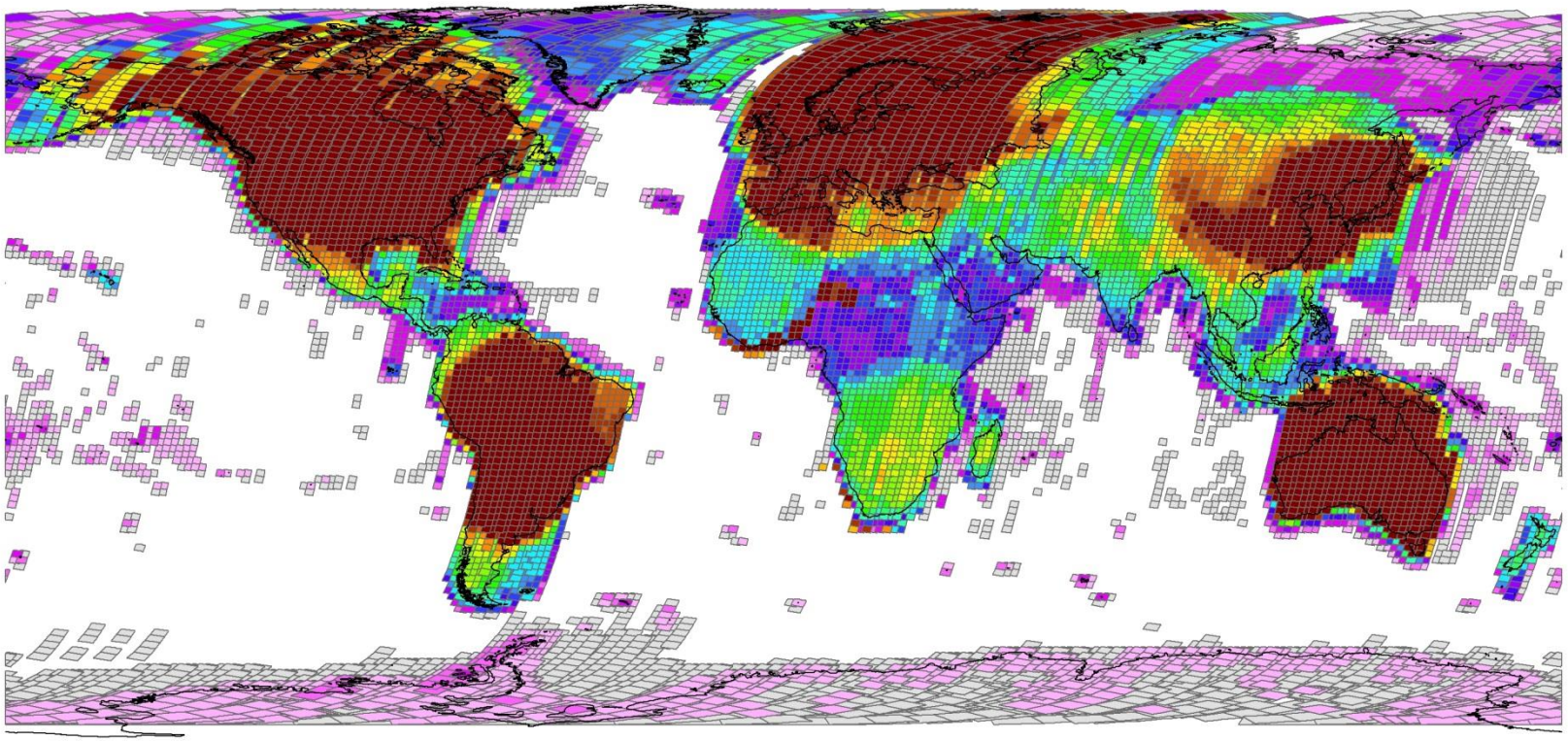
Number of images

1-50	200-250	400-450	600-650	800-850
50-100	250-300	450-500	650-700	850-900
100-150	300-350	500-550	700-750	900-950
150-200	350-400	550-600	750-800	>950

Archive holdings as of January 1, 2015

Wulder, et al. 2016. RSE.

Future archive once outstanding images added



Number of images

1-50	200-250	400-450	600-650	800-850
50-100	250-300	450-500	650-700	850-900
100-150	300-350	500-550	700-750	900-950
150-200	350-400	550-600	750-800	>950

Potential future archive holdings (with LGAC)

Wulder, et al. 2016. RSE.

Some Lessons Learned From Bulk Landsat Science Data Processing

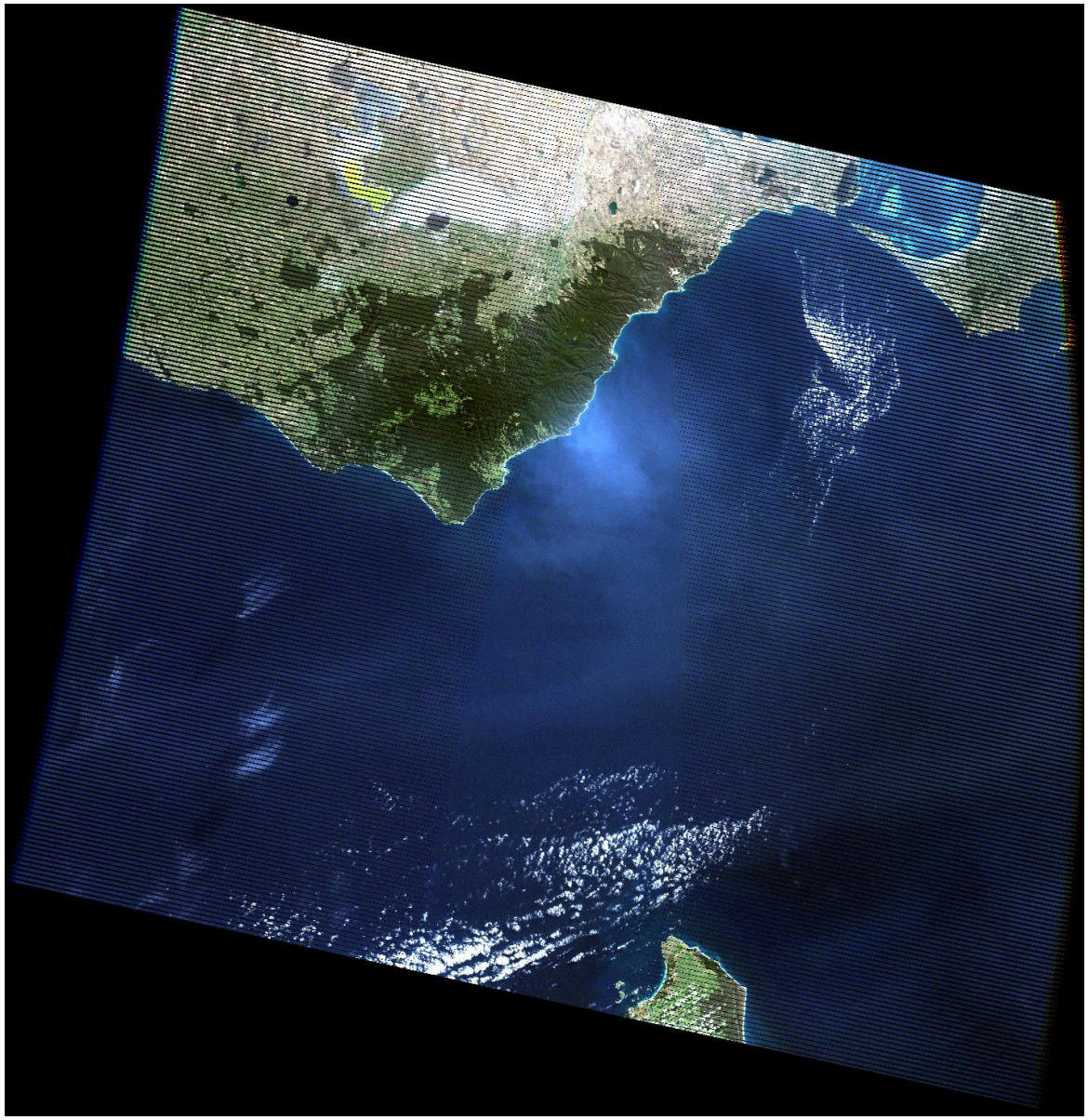
Summary Slide from a David Roy presentation at the

Landsat Science Team, USGS EROS Center, Sioux Falls, August 16-18 2011

- You cannot hit a *big red button* to make reliable large area and/or long term Landsat higher level science data products
- Get the product out early, Ensure mechanisms to involve the user community in product QA
- Routinely QA the input data with validation
- Reprocess products as needed
- Implement and manage a product versioning scheme
- Science algorithms developed on individual scenes don't necessarily provide consistency between scenes
- Product Quality Assessment challenge increases with data volume, algorithm complexity and product dependencies
- Expect schedule creep in Science Product Development

Version 3 NEX WELD rejections

- PERIOD : 07_2009
- ALL L5+L7:
- NUMBER STAGED SCENES : 20309
- NUMBER REJECTED SCENES (NOT L1T) : 4763
- NUMBER REJECTED (RMSE > 30m) : 49
- NUMBER REJECTED (SOLAR ZENITH > 85): 0
- NUMBER SCENES CONSIDERED/PROCESSED : 15497



All is well ! A relief that the _GEOM file was not produced for this mutant (see attached) its Eastern edge is not parallel to its Western edge and it has a non-standard size (7091 x 7311 pixels). No way sh/could the code handle this.

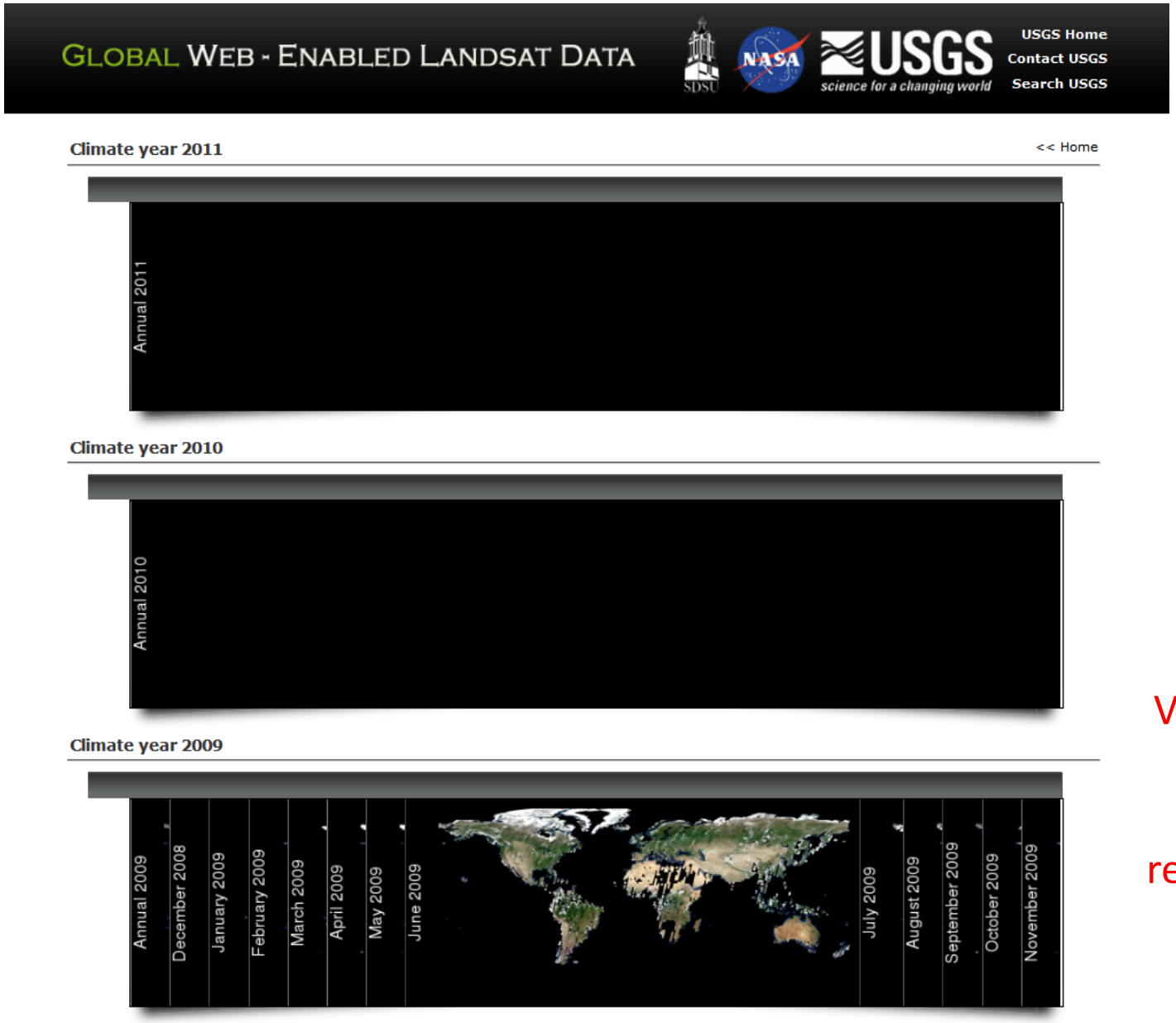
If the _GEOM file does not get produced then the UTM image will not get used in the Tile processing.

Petr, if its easy would be interesting to know what percentage of a global month has “The R-sq of edge fitting is only …” errors.

Hank, tomorrow please check L457.geometry.v1.5.c and see what the R2 threshold is to exit the process (this was something Junchang and I worked on pre-Val).

Science needs for derived Higher Level products

- Algorithms
  - recent, peer-reviewed, responsive to science community requirements
  - taking advantage of improved sensing technology
- Standardized products
  - format
  - filename convention
  - content structure (e.g., data layers, metadata etc.)
  - documentation
  - versioning (perhaps also collections)
- Dedicated scientists & support staff to
  - develop, code, and document algorithms & products
  - monitor/define product quality and product accuracy
  - refine algorithms as needed
  - develop software tools for product manipulation
  - weekly telecons
- Systematic production on dedicated computing facility, allowing
  - long term global production
  - sophisticated pre-processing and use of ancillary data sets
  - reprocessing to achieve stability of products over long time periods
  - production efficiencies (e.g., for products that share common inputs)



Global WELD Version 3.0 (NBAR surface reflectance) available February 2016

Landsat 8
red, green, blue
TOA reflectance

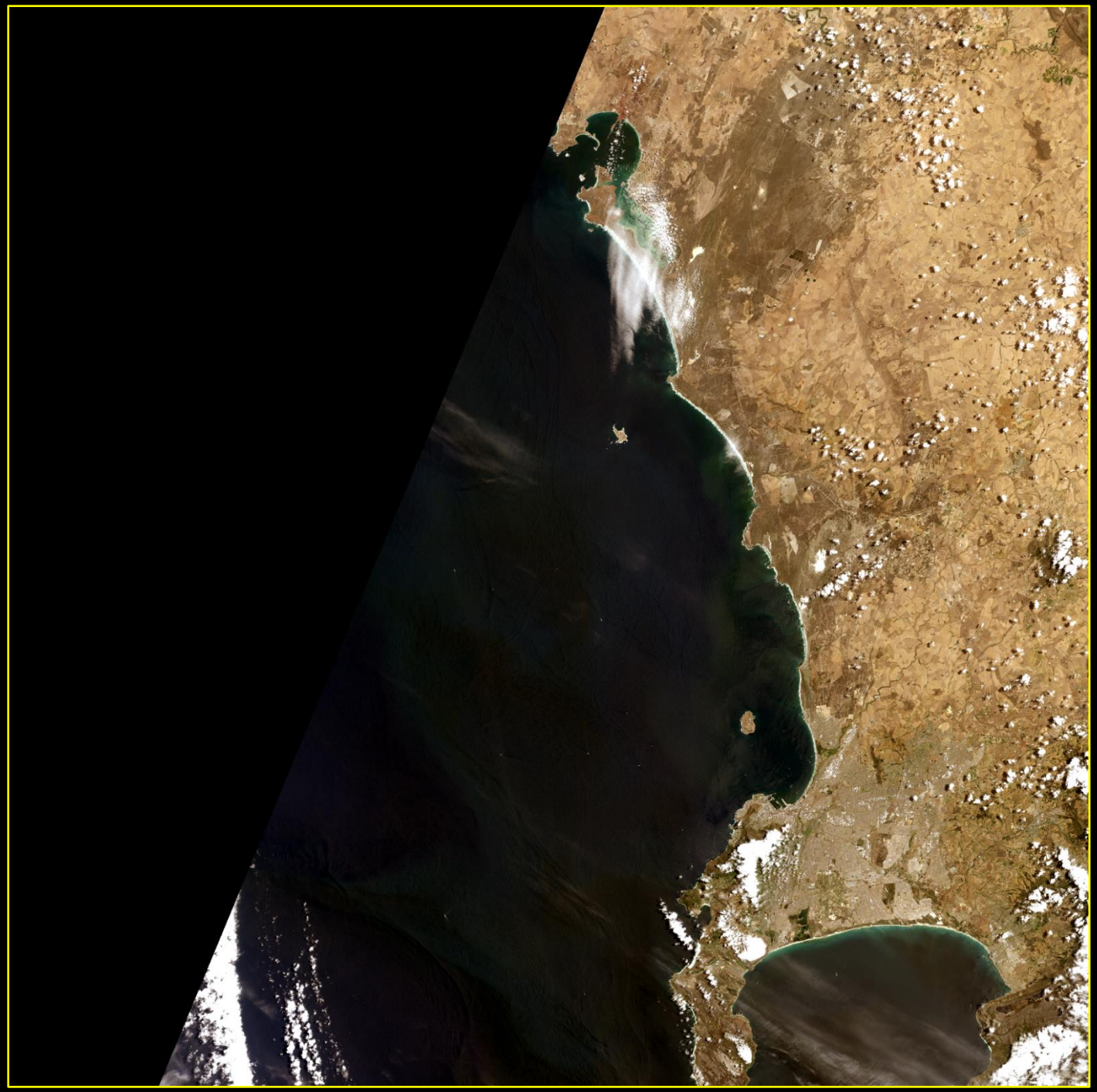
Cape Town,
South Africa

WELD week 49
(December 3 - 9 2015)

2 input L1T images
sensed:
December 8
08:35:04
08:35:28

nearest neighbor
resampled to
global WELD tile
hh19vv12h3v2

5295 x 5295 30m pixels



Sentinel 2A
red, green, blue
TOA reflectance

Cape Town,
South Africa

WELD week 49
(December 3 - 9 2015)

1 input L1C image
sensed:
December 8
08:50:36

box car
resampled to
global WELD tile
hh19vv12h3v2

5295 x 5295 30m pixels